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H. C. PARMELEE, Editor

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The President's Views On the Industrial Crisis

PEACEFUL and law-abiding citizens must have felt a bond of sympathy with the President as he recounted to Congress the story of his voluntary, but unsuccessful, efforts at mediation in the industrial crisis that faces the country. It is a record of patience under repeated rebuffs. If this were all, it would be disheartening; but there is ample evidence that the Chief Executive not only has his feet firmly on the ground but has his head high enough above the clamor and turmoil of industrial dispute to be able to see clearly and think straight on principles involved in the troublesome issues that treaten the nation. A strong advocate of respect for law and constituted authority, he logically seeks legal measures to insure the freedom and promote the peace and prosperity of the people.

Above all else President HARDING'S recent message to the Congress was a brief in the interest of the American people. Incidentally it did point the way to the only lasting solution of the coal problem and also pledged the powers of the government for maintaining transportation; but far transcending these matters in importance was the assurance that "no matter what hardships may attend or what sacrifice may be necessary, government by law must and will be sustained."

The President's demands for Congressional support and assistance are only those which an understanding people recognize as indispensable. There is no request for laws that will accelerate or force the settlement of present difficulties, for, wisely, the President is most concerned with righting a situation that will make their recurrence impossible. The message strikes at the very fundamentals of our trouble in the coal fields. Only by the elimination of evils that have led to the grossly excessive number of mines and miners can this industry be put on a sound economic basis. The fact-finding commission is the logical agency for attacking these basic problems. But this commission should, in our opinion, be vested with broadest powers, not only to investigate but to act and demand the necessary reformation and economic reorganization of the industry. The sooner this commission can function the better, for unless quickly forestalled further trouble is inevitable either next spring or at the expiration of whatever wage agreements are now to be effected.

With respect to the proposal of a "temporary national coal agency" to control the purchase and distribution of coal, there will be less accord. It is to be regarded only as a measure of final resort in case the operators are unable or unwilling to serve the public at a fair price. Fortunately the latter class is but a small proportion of the industry, which for the most part has loyally co-operated with the government.

In the opinion of those well informed on the subject the emergency would be passed before a commission of this kind could begin to function effectively. Developments immediately following a resumption of coal mining are likely to indicate whether or not a government agency of this kind is necessary.

It is hoped that present negotiations pointing toward a settlement of the rail strike will include some mutual agreement for observance and respect of the decisions of the Railroad Labor Board. Nevertheless the need for strengthening legislation has been clearly shown by the developments of the past year. When the Esch-Cummins law was enacted it was without precedent on the statute books and naturally after a considerable period of operation Congress may well consider a number of perfecting amendments.

In concluding his message the President laid down the broad principles on which the government purposes to act in putting an end to lawlessness and violence. For these principles we have nothing but commendation and approval. With him we thoroughly believe: "It is fundamental to all freedom that all men have unquestioned rights to lawful pursuits, to work and to live and choose their own lawful ways to happiness." Once this principle is universally recognized there will be no class domination nor will the public welfare be surrendered to a small minority that has the temerity to oppose the organized forces of law and order.

The Senate Raises Rates In the Chemical Schedule

DETAILS of the Senate's final action on the chemical schedule of the tariff will be found in the news pages of this issue. Our correspondent states that debate waxed warm at various stages in the consideration of the bill, with opponents and proponents lined up as they have been throughout the tariff debate.

The general result of the Senate's deliberations on coal-tar chemicals was a rejection of the proposed embargo and substitution of an amendment by Senator BURSUM offering higher rates on coal-tar intermediates, dyes and chemicals. Not only was the ad valorem rate on intermediates raised from 50 per cent to 75 per cent, but the fixed duty was increased from 7 cents per pound to 10½ cents. Similarly rates on coal-tar chemicals and dyes were increased from 60 per cent and 7 cents per pound to 90 per cent and 10½ cents per pound. This amendment, coupled with the provision for so-called flexibility in the rates to July 1, 1924, represents the limit of the Senate's protection of the chemical industry.

The bill will now go to conference, where an effort will be made to harmonize rates in the House and Senate bills. The outcome cannot be foretold, because the Senate has made radical modifications in the Fordney bill. There are, however, in both houses of Congress warm advocates and strong supporters of the chemical industry to whom we can look with confidence for a strong fight in support of protection.

A Naïve Confession

PROMINENTLY displayed on the front page of a metropolitan daily last Friday was a press dispatch from Chicago featuring a statement by the dean of the College of Liberal Arts in Northwestern University to the effect that henceforth married instructors will not be engaged in that institution unless they have independent means. It seems that although "salaries at Northwestern are as high as in any other university," the cost of living in Evanston is unusually high and the social demands are greater than in most university towns. The terrible consequence is that instructors are unable to live and support a family on their meager salaries of from $1,600 to $2,500. Hence their wives seek positions in the peaceful Chicago suburb in order to eke out the family budget. All of this induces worry and leads to such a distracted state of mind over debts and other little domestic problems that the instructor is unable to concentrate upon his work and his educational value suffers accordingly.

And all this is given out in a sober, academic statement, apparently without regard for the number and variety of jokes it contains. First, there is the naïve confession that Northwestern is not giving its married instructors even the "living wage" which is scorned by all well-informed and intelligent labor leaders. Next is the paradoxical reference to college instructors with independent means. Why be a college instructor at Northwestern or any other school if one has independent means? But the remedy proposed is still more unique. Dismiss married instructors altogether, rather than meet a patent obligation and keep happy, contented workers. Perhaps this simple expedient will not be immediately appreciated outside of the department of sociology and economics—but what a ghastly joke the whole thing is on a married instructor in that department!

Perhaps the new ruling at Northwestern does not apply in the departments of science and engineering, but wherever applied it must inevitably have the effect of lowering the quality of instruction through the employment of immature instructors. In business the married man is more likely to be regarded as an asset than a liability. It is recognized that he has not only assumed duties and obligations that make for stability but also that he has reached a state of maturity that implies greater ability. But not so in the College of Liberal Arts at Northwestern. Here one must have a wealthy wife or riches in his own right, although we hope that the new ban on married instructors will not apply in technical courses, where it is recognized that immature instructors should not be employed. One of the conclusions reached by the committee on chemical engineering education of the American Institute of Chemical Engineers was that graduate students should not be used as major instructors in chemical engineering, even in the freshman year.

If universities want quality in instruction, as in other lines of human endeavor, they must pay for it. Recently we ventured the opinion that colleges would have to compete with industry in order to hold on their faculties men of exceptional promise. It begins to look as though the humble instructor is in greater need of our solicitude. It is from the ranks of instructors that universities recruit their professors of high and low degree. Brilliant students, who give promise of an equally brilliant academic career, expect to travel the familiar route to a professorship via the humble instructor's job, meanwhile working for a higher degree and earning enough to live on. If the first step in this customary routine is made so unattractive that a man must be a bachelor in domestic affairs as well as one of arts or sciences, the range of candidates from which faculties are to be recruited is narrowed not only in quantity but in quality also. Educational institutions generally must wake up to the necessity of competing for men on a business basis.

Wanted—Competition In the Coal Industry

IN OUR ISSUE of April 12, 1922, we pointed out that the waste in the coal-mining industry due to idle labor and idle capital is much greater than the waste in mining methods, about which so much has been said in the plea that we should think of posterity. It is only lately, through the prompting of the greatest strike in the history of the bituminous coal industry, that much has been said about the waste of workmen's time and of capital.

Now the subject is really up. F. S. PEABODY, a prominent coal operator and member of the A.I.M.E., uses particularly plain language in expressing the thought that is prominent in the minds of many men —that what is wanted is competition in the coal industry. Mr. PEABODY says there must be a weeding out of coal mines by competition, leaving the fittest to survive and work practically full time. He takes the conservative basis that the developed capacity is fully one-third greater than any possible demand, sets the excess capital at $400,000,000, the excess in miners at 200,000 and the excess cost of all this at $400,000,000 a year, 80 cents per ton of coal, which the country is paying in an excess coal bill.

The question is how to produce competition. It is a question that has never been up in a large way. Experience in human affairs shows that as a general rule there is a strong tendency for competition to arise, while men are disposed to devise artificial means to restrict competition. Hence we have been more or less busy with the problem of preventing the stifling of competition. We have the common law, converted into precise form by the Sherman law of 1890, and lately we have had the Clayton and Trade Commission acts.

Our general policy has been that if we prevent the restriction of competition we do enough. The question now is whether this policy is wrong or we have overlooked something in endeavoring to carry it out. Studying the history of the coal industry in the past quarter century or more, we find little suggestion that the familiar methods of trade restraint have been practiced, and we find furthermore that it would be particularly difficult to operate a price agreement in coal. There are many operators, of various sizes, and they are plainly difficult if not impossible to "control." Then there is the nature of the business, coal-mining districts being scattered over a large part of the country, each with its tributary consuming territory, and each with its own price.

Nevertheless, the plain fact is that competition, as a means of keeping prices down to a fair average level, has failed in the case of coal. The reason is conspicuous and simple. Our law forbids coal operators as well as other producers of commodities to agree with

one another to restrict production. The law does not forbid the coal operators to disagree with the United Mine Workers. Thereupon the United Mine Workers go on strike, and sometimes even close non-union mines, as they did this time in the Connellsville and some other districts.

It is seldom that the answer to a great problem is in advance narrowed down so precisely. It may be difficult of execution, but its general character is predetermined. The study must be prompt and vigorous, for while there have been biennial scales in the bituminous coal industry in the past, the recent "settlement" of the United Mine Workers runs only to April 1, 1923, seven months hence.

On Casting Steel, Copper And Other Things

MANY a foundryman will contend that the hardest casting to run in gray iron is not an intricate thing like a valve body, but a simple straight round bar. Many an argument has arisen over the proper way to mold it, and where the gates and risers ought to be. How to produce sound, perfect castings of this shape seems never to be settled to everybody's satisfaction.

Those same questions constantly confront the caster of ingots or slabs. He continually must make bars of solid metal in unexceptionable surface condition, especially when they are to be rolled into thin sheets. Furthermore, such is the kinship among metals that the precautions necessary for casting fine steels, so ably described by Colonel BARBA before the Mining Engineers last winter, are paralleled in non-ferrous practice.

To illustrate, consider the pouring of a long round "billet" of copper, to be pierced and worked into seamless tubing or bands. Assume that delicate furnace refining has put the metal into the exact "pitch" to solidify with a flat surface. A laborer dips a big ladleful from the bath, keeping some of the glowing charcoal floating on top to prevent oxidation of the metal en route, and trundles his load to the molds. Each one of these consists of a series of copper rings bored to a mirror finish and machined at the grooved joints; the lowest section has a pouring gate entering the bottom. A second workman empties a small hand ladle through this runner, and when the metal wells up, covering the bottom of the mold, the bull-ladle starts pouring from the top. In this manner all splashing is prevented. As the first section fills, the next ring is placed in position smartly, the ladle of hot copper meanwhile being raised by chain block, and pouring is resumed with the slightest delay. For such practice, the copper of course must be hot, so that fresh metal strikes a liquid pool and the stop-pour causes not the slightest defect. And so on until the 4-ft. bar is completed.

By the time the first section is poured the metal in the small gate is chilled, and by the end of the pour the billet is solidified possibly for half its length. The mass of the mold sections is most carefully adjusted for this rapid chilling effect; indeed the rate of solidification is balanced against the temperature of the metal, the temperature of the mold, the pouring rate and the "pitch" or gas content in the bath. It is therefore only the matter of a minute before the billet freezes with a flat top and without internal cavities or pipe of any sort. The molds are lifted straight up, section by section, off the red hot bar, and the lowest one opens on a parting. After partly cooling in water, they are slushed with bone-black, and are ready for another pour.

Here are seen the essentials of correct ingot pouring: Most carefully refined metal; correct temperature of metal and mold; the surface of the mold perfection indeed; absolute prevention of splashing, close control of pouring rate; quick stripping of molds. These things attended to, no difficulty is had in producing as a matter of course ingots of this shape—undoubtedly the most difficult yet devised to worry the caster—and of a quality so excellent that most exacting specifications covering the interior and exterior surface of tubing can be met with ease.

Illustrations need not be multiplied. This one perhaps suffices to convince that melters of copper, brass, bronze and aluminum could profit equally with steel makers from a study of the principles set forth on page 350, so ably enunciated by Colonel BARBA and the lamented Dr. HOWE.

Prehensility— Comprenez Vous?

WE REFERRED the word to one of our colleagues, who said he thought it must be the property of having a long and waving tail. We informed him that he was wrong, whereupon he said that it must be the property of having a short straight one.

It is neither. In fact it is a term applied to adsorbents in producing high vacua. It is the conception of seizing hold of the gas molecules rather than retaining them. It is greatest with plum-stone charcoal and less with birch charcoal, coconut charcoal, German charcoal, etc. Mathematically it is the slope of a curve about which the reader can discover more details by referring to the *Proceedings* of the Royal Society of Edinburgh.

The word, however, will serve admirably as a text. It represents a tendency—and not a healthy one—which may perhaps be described as the desire to coin a vocabulary. Of course, a definite and specialized vocabulary is necessary in chemistry and physics to express and co-ordinate the knowledge which those sciences have given us. And yet we feel that too little care and thought have been given to the niceties of language and the demands of good literature. In the case of "prehensility" the word is so definitely associated with the ability of monkeys to seize an object with their tails that it seems grotesque to develop a new application with reference to adsorbents. Language is already too complex, and words are too lightly added to an already overextended vocabulary. In fact, if we were not protesting against the practice, we might offer a dissertation on "nomenitis," the disease of naming things.

According to MARK TWAIN, NOAH had a simpler and more logical method which he applied when he was called upon to name the animals. As they passed in review he named them according to their appearance. Thus the lion looked so much like a lion that there seemed to be no chance of naming it anything else; and the giraffe—who could mistake that long neck and peculiar shaped body? It must be a giraffe, no other name would fit. And so on through the whole list. There is much to commend in the simplicity of NOAH'S system. Try it in the case of "prehensility" and see if you can visualize an adsorbent wrapping its tail firmly around a gas molecule, seizing it beyond the possibility of escape!

Readers' Views and Comments

Acid-Proof Material for Arsenic Acid Manufacture

To the Editor of Chemical & Metallurgical Engineering

SIR:—Referring to my contribution in your issue of July 26 on "Calcium Arsenate Manufacture," which on account of haste I did not see in proof before publication, my attention has been called to one slight inaccuracy which requires notice.

In the description of acid-proof material used for arsenic acid manufacture my article as written referred to Duriron, as this is the only alloy, to my knowledge, which has been successfully used for the apparatus described. Your editor in changing the wording (I assume to eliminate from a technical article reference to a commercial name) substituted for the word "Duriron" the words "high-silica iron." This phrase is not correct according to my understanding, as Duriron is properly termed a "high-silicon iron" or a "ferro-silicon."

The alloy was referred to in this article not in any broad or generally descriptive sense, but to indicate definitely the material already proved suitable for a requirement permitting radical improvement in the production of this acid. To my own knowledge costly failures have resulted from efforts to use other kinds of iron kettles for this particular purpose and I would naturally prefer not to appear to write authoritatively on the subject with such phraseology as might be misconstrued.

With the desire for accuracy which I know you have and which from my personal standpoint is equally desirable I am suggesting this correction.

New York City. H. W. AMBRUSTER.

Dezincification of Brass

To the Editor of Chemical & Metallurgical Engineering

SIR:—I should like to take issue with the investigators of the Corrosion Committee of the British Institute of Metals[1] upon their conclusion that true dezincification of brass never occurs. Microscopic examination of dezincified samples of Admiralty alloy submitted to me indicates very clearly that zinc has been removed and the copper left in place. Spongy, brittle copper remains, occupying exactly the same space and position, and in every way apparently exactly what should be left, provided the zinc had been dissolved out of the brass. Small particles of brass are frequently found in this mass in the form of crystals or islands of the original metal. I have seen corroded tubes where copper has apparently been re-deposited, but the experience of the American Brass Co. with condenser tubes does not lead us to think that this can be anything but a very extraordinary case resulting from abnormal conditions of exposure.

We very seldom find tubes in the same condenser differing in the character or amount of adhering deposit. In some condensers the tubes have a very hard, one might say "stony," deposit. Such tubes have lasted for a long period in sea water service. On the other hand, where condenser tubes fail in a very short time they generally do not possess such a deposit. The deposit is either partly wanting or is very soft and apparently slimy when wet, and after being dried out it has not the continuous enamel-like appearance referred to.

Waterbury, Conn. W. H. BASSETT.

[1] See "Results Achieved by the Corrosion Committee, British Institute of Metals," *Chem. & Met. Eng.*, Feb. 15, 1922, vol. 26, p. 301.

A New Vessel for the Absorption of Hydrochloric Acid

To the Editor of Chemical & Metallurgical Engineering

SIR:—Under the above title in your issue of Aug. 2 Stephen L. Tyler states that "The tower has been used extensively for the absorption of hydrochloric acid gas, but from this it is possible to produce only acids of low strength, as it is not practicable to construct absorption towers with sufficient cooling to keep the tower temperature down to a point where high strength acid may be produced."

In my report on the operation of the plant at Emporium in *Chem. & Met.*, Nov. 2, 1921, page 834, it is shown that 20 deg. Bé. acid is regularly produced without the use of any absorption apparatus but towers and from gases running as low as 3 per cent HCl. The necessary cooling is obtained by circulating a large volume of acid with pulsometers. M. A. LAURY.

Rockville Center, L. I.

To the Editor of Chemical & Metallurgical Engineering

SIR:—In my article on "A New Absorption Vessel for Hydrochloric Acid" which appeared in your Aug. 2 issue a number "1" is omitted from Fig. 4. It should be placed opposite the upper layer of air-cooled coils. It is referred to in the text and without it there might conceivably be some confusion. I would appreciate your calling this to the attention of your readers.

New York City. S. L. TYLER.

The Technology of the Carbon-Electrode Industry

To the Editor of Chemical & Metallurgical Engineering

SIR:—The fourth article of the series on "The Technology of the Carbon-Electrode Industry" contains two rather unfortunate errors of typography, the effect of which, in one case at least, is entirely to reverse the writer's original meaning. Thus on page 259, under the heading "Comparison of Molding and Extrusion," the word "not" has crept into the fourth paragraph and should, of course, be omitted. The paragraph would then read: "In the case of large electrothermal electrodes, the high density and low resistivity of the electrode are as important as when smaller currents are used."

Again on page 260 it would seem that the captions for the illustrations had been reversed. The press shown in the cut on the right has a capacity of 750 tons and not 350 tons. It is obvious, I believe, that the comparative sizes of the presses do not agree with the capacities which you have indicated.

I shall be obliged to you if these corrections are brought to the attention of your readers.

Brooklyn, N. Y. CHARLES L. MANTELL.

Ido, the Universal Language

To the Editor of Chemical & Metallurgical Engineering

Sir:—As a subscriber for *Chem. & Met.* I take the liberty of presenting one reader's views and comments on the synthetic language Ido.

Ido

(How is it pronounced?)

There once was a pup dog named Fido
Who became quite proficient in Ido,
For German and French
Gave his tongue such a wrench
As to force him to cut quite a dido.

His master, a likeable kiddo,
When of age fell in love with a widow.
Though she came from far Burma,
Their love was the firmer
Because they could say it in Ido.

In movies the next thing that he do
Is to come to a clinch just like she do.
'Twas a suitable match
For they came to the scratch,
And whispered soft nothings in Ido.

Her father, whose wealth was his credo,
Soon asked of the young man had he dough.
"I've houses and land,
And coin plenty as sand,"
He answered quite glibly in Ido.

Washington, D. C. C. E. WATERS.

The Chemical Industry in Chile

FROM OUR SANTIAGO CORRESPONDENT

SANTIAGO, CHILE, AUG. 1, 1922.

CHILE has developed a flourishing industry by means of obtaining and preparing chemicals in their original state which are especially intended for the export trade. The names of these products, with the amounts produced during the past 3 years, are given in the following table:

	1918	1919	1920
Sodium nitrate, metric tons	2,875,902	1,703,240	2,523,458
Iodine, kg.	1,078,760	243,167	350,066
Calcium borate, metric tons	6,603	10,116	15,823
Sulphur, tons	19,557	18,910	13,340
Perchloride of potassium, kg.	118,327	20,696	33,487
Sodium sulphate, metric tons	1,220	.....	.....
Sodium chloride, metric tons	54,536	29,454	33,951

During 1921 interesting deposits of sodium carbonate were discovered, 50 per cent pure, the remainder being mostly moisture and organic matter. The extraction of these products is destined to develop an extensive industry, as the deposits are important and the transportation lines now under construction will permit of the products being moved with ease for shipment to foreign markets.

MANUFACTURE OF CHEMICAL PRODUCTS

The manufacture of chemical products has had a slow development in Chile owing principally to the small consumption, the variety of products which are needed in the work and the difficulty of transportation due to the configuration of the country. The manufacture of sulphuric acid, which is a vital industry, has not thrived. A premium of $0.05 (Chilean gold) per kilo of 66 deg. acid was allowed and a factory was opened in Guayacan, Coquimbo, using the contact process, but it shut down as soon as the payment of the premium was withdrawn. At present there are several factories producing sulphuric acid by the chamber process. Of these, two are operated solely for the purpose of supplying the mining camps of Teniente and Chuquicamata, which depend on them for their supply of sulphuric acid, and three to supply the public demand. In almost all of these factories, with the exception of Teniente mine, native sulphur is used. Chamber acid and 66 deg. acid are the only forms produced at present, no fuming ever having been made. Hydrochlorate and nitric acid for commercial use are also manufactured. Small quantities of acetic acid are manufactured, notwithstanding the fact that sodium acetate is exported.

In the line of basic chemistry, development has been confined to the crystallization of sodium carbonate. In the nitrate regions an impure sodium carbonate, called "natron," is produced by burning nitrate with carbon. This is used for the manufacture of solutions of bisulphite used to extract iodine.

The deposits of sodium sulphate in the northern part of the country and the consumption of caustic soda and salts there would serve as an economic basis for establishing a factory to produce Leblanc carbonate in Antofagasta and its environs.

Among the ordinary chemical products locally manufactured are boric acid, iodide of potassium and sodium, nitrate of silver, sulphate of copper, iron and aluminum, refined cream of tartar, ordinary ether, glycerine, compressed oxygen and carbon dioxide, naphtha and other products of minor importance.

The wood-distillation industry is still in its infancy, several small factories having been established which produce methylene and calcium acetate. There is a large factory which produces tannic extracts, using the bark of the elm tree, and also a factory producing paste for mechanical purposes, using the bark of the *Araucaria imbricata.*

There are five factories producing illuminating gas, two of them having tar distilleries, although they only separate the raw products without crushing or refining them.

There are several oil factories producing olive, castor, cottonseed, linseed and other similar oils. Industries utilizing fats are only beginning to be built and the manufacture of soap is carried on along very primitive lines. There are some plants for the recovery of glycerine.

The manufacture of all kinds of fermented products is conducted on a large scale, excellent wines and beers being made, and alcohol is produced in greater quantity than that needed to supply the requirements of the country. There are several small starch and gluten factories. The tanning and allied industries are very much developed, local material being used from which a very good grade of hides is produced.

The Record in Pulverized Coal Installations

Chemical engineers have followed the extensions in the use of pulverized coal for fuel with much interest. Combustion is primarily the province of the chemical engineer and the extension of improved combustion methods affects him in many ways.

In this connection it is worth while to note the equipment which is to be used in the Cahokia Station of the Union Electric Light & Power Co., St. Louis, Mo. This plant, an eventual 240,000-hp. development, will raise steam with B. & W. boilers fired by the "Lupulco System" of pulverized coal burning, installed by the Combustion Engineering Co. The coal will be powdered in a battery of ten Raymond Six-Roller Low-Side Mills. This pulverizer installation will comprise, so far as can be ascertained, the largest single coal pulverizing installation so far made for any purpose whatever.

What's in a Name?

The Moot Question, Does the Trademark Belong to and Protect the Business or Does It Protect the Consumer? Is Discussed and Illustrated by Recent Celebrated Cases—The Effect of This Point on Commercial Transactions Between Americans and Foreign Corporations

By Wellington Gustin
Of the Chicago Bar

THE rights carried by a trademark covering one's products appear to be not very definitely defined in the rules of law, nor settled by decisions of the courts. "What's in a name?" in a business sense is of grave concern to business from more than one angle. Is a trademark and trade name something to be protected by the laws for the benefit of its claimant or for the benefit of the public? Is it a right or property for the protection of the business and products of private individuals, or is it a right to be enforced by the laws and rules of equity for the prevention of frauds upon the public? Some recent cases in the federal courts show a state of uncertainty as to these matters.

The Purchase of Exclusive Rights to Foreign Trademarks

The question chiefly involved in this article concerns the importation and sale in the United States of products manufactured under a trade name or mark in a foreign country, where the manufacturer has sold his rights to the name or mark in this country. Under one line of decisions the tendency is to permit an importer to sell foreign trademarked goods in this country, though an American firm may have purchased and owns the trademark rights in this country, provided, of course, the importer has purchased the products from others than the manufacturer. The proposition has not been passed on by the United States Supreme Court, and there are other points of law connected with the rights to a trademark not yet settled. The importance of the subject is obvious, when we remember the chemical products and their trade names of German manufacture sold to American interests during the late war.

The Java Poudre Case

A case now pending in the United States Supreme Court on a writ of certiorari to the United States Circuit Court of Appeals for the Second Circuit concerning trademark rights and unfair competition is of great importance to all users of trademarks and trade names, A. Bourjois & Co., Inc., vs. Anna Katzel (42 Sup. Ct., 92).

A. Bourjois & Co., Inc., a New York corporation, brought suit for an injunction against Anna Katzel. The company is the exclusive owner of certain registered trademarks for face powder, these trademarks consisting of the word "Java" and the various labels which are carried by its boxes and serve to identify them as its products. Anna Katzel's boxes are, with two differences, exact duplicates of plaintiff's boxes.

In 1912 the firm of E. Wertheimer & Cie. of France, successors of A. Bourjois & Cie., also of France, had established in the United States the business in Java face powder in boxes under labels substantially the same as those in controversy. The plaintiff New York corporation, mentioned above, was organized in 1913, and for a consideration involving, *inter alia*, the obligation to pay $400,000, bought the entire business then and theretofore carried on by A. Bourjois & Cie., E. Wertheimer & Cie., successors, in the United States—namely, the entire good will of said business in the United States, and any and all trademarks, trade names and trademark rights relating thereto in the United States, and also the sole and exclusive right to manufacture and sell in the United States any and all toilet preparations then or theretofore made by the French concern. This transfer of trademarks included the transfer of the registered trademark "Java," the top and other labels of the boxes, and all of the trademarks which the plaintiff had subsequently used and registered. Thus, the District Court says, all of these trademarks and labels are, so far as the United States is concerned, exclusively the property of the New York corporation.

Promotion and Development of Market

It appeared that the company in suit has expended substantial sums of money for advertising and has created a wide market in the United States for its products, building up not only an extensive and important business, but also an excellent business reputation for the character of its products, and that it depends in greatest measure upon its trademarks to prevent invasion of its rights.

Plaintiff buys the powder in bulk from the French firm, A. Bourjois & Cie., and then puts up this powder in the boxes containing the trademark inscription. The District Court says, however, that plaintiff may buy its powder from any house, and will obviously do a favorable business in connection with its trademarks, so long as it satisfies the public, which it has done in the past. Two outstanding features of its packages consist of the words "Poudre Java" and "A. Bourjois & Cie."

Defendant Imports the Same Material

The facts further showed that the package sold by the defendant, Anna Katzel, was the genuine box or package of the French firm of A. Bourjois & Cie., and that defendant had bought abroad the products contained in the genuine packages and same were imported into this country.

On the back of plaintiff's box or package are the following words: "Trademarks Reg. U. S. Pat. Off. Made in France—Packed in the U. S. A. By A. Bourjois & Co., Inc., of New York, Succ'rs in the U. S. to A. Bourjois & Cie. and E. Wertheimer & Cie."

As the defendant's box or package is manufactured and sold in France, the words just quoted do not appear upon it. It was urged by defendant that plaintiff's product is a misrepresentation and in the nature of a fraud upon the public, in that it gives the impression that it is manufactured and put up in the original packages in France. But the court found that

the public had full notice of the facts due to the quotation above on plaintiff's packages.

From the above facts the United States District Court regarded the important question in the case to be whether, because defendant's package is a genuine article made and sold by the French concern, it can be said to constitute an infringement of the trademarks of plaintiff, when plaintiff is the exclusive owner of these trademarks in the United States.

The court points out that a trademark has come to be recognized as a property right of immense and incalculable value, and that the proprietor of a trademark by virtue of the manufacture or offering for sale of his goods is entitled to the protection which the highest powers of the court can afford.

In another case the Supreme Court of the United States holds that redress is based upon the party's right to be protected in the good will of the trade or business and the English rule that a trademark is not the subject of property, except in connection with an existing business, prevails in the United States. However, the court has held in Scandinavia Belting Co. vs. Asbestos & Rubber Works (169 C. C. A., 87) that the owner of a registered trademark can restrain its use by another, though no loss of sales is shown and though there may be no fraud between the original seller and buyer of the infringing article.

Judge Mayer's Able Opinion Supported Plaintiff

The District Court found that defendant's trademarks was genuine, in the sense that it was not spurious at the place of origin, and that no change has been made since it was sold; but it says it is genuine as matter of law only if defendant has the right to sell within the territory where plaintiff is the exclusive owner of the trademark, and also where plaintiff has established a business in the product in connection with the trademark.

The court further found that plaintiff has expended a large sum for the acquisition of the trademark title and rights and for the advertisement of its business. Further it had corralled the American market before defendant's boxes were brought into this market. If now, says the court, the original French boxes or packages can lawfully be permitted to compete with plaintiff's boxes and packages, it is seen that plaintiff's business may be destroyed, and in any event impaired.

The question, says the court, is one involving business interests in a large way. If an American business concern buys all the rights of a business established here by a foreign concern, and then the foreign concern is nevertheless at liberty to compete with the American concern, the result will be that the purchase of rights, under such circumstances, will give little or no protection, and the foreign concern as well as the domestic concern will be seriously injured in the long run, because American capital certainly will not be invested, and foreign concerns will find it difficult to sell the rights which they have developed in this country.

Defendent Believed She Was Within Her Rights

The court says in justice to A. Bourjois & Cie. of France that nothing in the record of the court proceedings would justify the conclusion that this competition has been undertaken with their knowledge or consent, and in justice to defendant that she has relied upon what she regarded her legal rights. The question is one of law which calls for definite and prompt settlement.

In support of her position in importing the original article and selling it, the defendant cited the case of Fred Gretsch Manufacturing Co. vs. Schoening et al., 238 Fed., 780. But the trial court in the case at bar shows that case involved a construction of section 27 of the act of Feb. 20, 1905 (Compiled Stat., section 9513). This section was in the nature of a customs regulation, to prevent the American public from being deceived by simulated name. Simulated trademarks were to be excluded from importation, so as to safeguard the American public. Under this law the customs authorities may only exclude an article "of imported merchandise which shall copy or simulate the name of any domestic manufacture. . . ."

Not a Question of Genuineness of the Article

Thus, says the court, if an article is genuine, in the sense of defendant's box, it may be imported into this country and cannot be stopped at the door of the custom house; but whether the article may be marketed here under a particular trademark is a question to be determined in ascertaining the rights of parties, quite irrespective of section 27. Section 27 concerns the action of the government, through its proper officials, in carrying out the safeguarding measures erected by Congress. The case at bar concerns the rights of private parties, and those rights depend wholly upon different rules of law. Therefore, in this case, wherein the original owner of the business and its trademarks had completely parted therewith to a vendee, who had proceeded upon the strength of his ownership to develop an American market, the court was of opinion that plaintiff is entitled to have defendant's product excluded from the American market and so granted an injunction to plaintiff.

Circuit Court of Appeals Reversed the Decree, 2 to 1

Despite this well-reasoned opinion by District Judge Mayer of the Southern District of New York the United States Circuit Court of Appeals has reversed the decree, in an opinion handed down by Judges Ward and Manton, but with Judge Hough dissenting.

Analogy to Hunyadi Janos Case

In this opinion the Court of Appeals assumes that it would be a breach of the French firm's obligations to the New York corporation to sell its face powder in the United States. Its products are imported and sold, however, by defendant herein. The question, as this court saw it, is whether the defendant has not the right to sell this article under the trademark which truly indicates its origin. And it decides that she has this right. It supports this view by the case of Apollinaris Co. vs. Scherer, 27 Fed., 18. Here the proprietor of the Hunyadi Janos spring in Hungary gave to the Apollinaris Co. the exclusive right to sell the water under the trademark "Hunyadi Janos" in the United States. The Apollinaris Co. registered the name and labels as trademarks in the United States Patent Office. Scherer applied to the proprietor, Saxlehner, to sell him the water for importation into the United States, which Saxlehner refused to do because of the granting of such exclusive rights to the Apollinaris Co. Thereafter Scherer purchased the

water from other parties in Germany, imported it into the United States and sold it under the name Hunyadi Janos and with the same label as the Apollinaris Co.'s. Herein the court says the defendant was selling the genuine water, and therefore the trademark is not infringed. There is no exclusive right to the use of a name or symbol or emblematic device except to denote the authenticity of the article with which it has become identified by association. The name has no office except to vouch for the genuineness of the thing which it distinguishes from all counterfeits; and until it is sought to be used as a false token to denote that the product or commodity to which it is applied is the product which it properly authenticates, the law of trademarks cannot be invoked.

Le Page's Glue Also Quoted

The Court of Appeals cited another case, Russian Cement Co. vs. Frauenhar, 66 C. C. A., 500. Here the defendant bought in bulk of third parties glue made and sold by the plaintiff under the trade name of Le Page's Glue and bottled and sold same under that name. The labels on defendant's bottles contained no statement as to whether the glue put up by it was either of a superior or inferior quality, but merely that this glue was manufactured by the plaintiff and bottled by defendants. The complainant urged that this was a fraud upon the public and that defendants should be enjoined from applying the name "Le Page" to a glue, though made by itself, which is inferior to the most expensive brands sold by complainant under that name. The court here said that if the public does get an inferior quality of glue when it purchases that bottled by defendants, it is because the complainant itself has seen fit to sell such glue under the same trade name as it had applied to a superior article. In the absence of an attempted fraud a court of equity will not enjoin a person from affixing to goods sold by him their true name and description. Here the label tells the truth and nothing but the truth, says the court. There is no fraud upon the public, for it gets the genuine, identical thing described by the label; and there is no fraud upon the manufacturer, for its vendees resell its manufacture, to which it has applied its name, coupled with the statement that it (the vendee) is responsible for the manufacture.

Eternelle Violin Strings

In another case the Gretsch Co. had the exclusive agency for the United States of the sale of violin strings made in Germany by Mueller under the name "Eternelle," and with Mueller's approval registered the name as the trademark in the U. S. Patent Office. Schoening purchased such strings in Germany and imported them into the United States. The case arose under section 27 of the trademark act (Comp. Stat., section 9513) as to the importation of merchandise copying or simulating a trademark registered in the U. S. Patent Office. Here the court says, "Assuming that Congress could protect the owner of a registered trademark against the importation by third parties of the genuine article under that trademark, has it done so? We think not. The act prohibits the entry of imported merchandise which shall 'copy or simulate' a trademark registered under it. The obvious purpose is to protect the public and to prevent any one from importing goods identified by their registered trademark which are not genuine. In this case, however, the imported goods were the genuine articles identified by the trademark."

But Trademark Is Not a Patent and Should Only Protect the Public

Returning to the case of Bourjois & Cie. vs. Katzel, the Court of Appeals points out that the analogy between patents and trademarks is not complete. A patent gives a patentee a monopoly to make, sell and use and grant to others the right to make, sell and use the subject patented in the United States for the term of the patent. Hence articles lawfully made, used and sold in foreign countries cannot be sold in this country if they infringe the patent. Trademarks, the court says, are intended to show without any time limit the origin of the goods they mark, so that the owner and the public may both be protected against the sale of one man's goods as the goods of another man. If the goods sold are the genuine goods covered by the trademark, the rights of the owner of the trademark are not infringed.

Judge Hough, Dissenting, Holds Trademark Primarily Protects Business

In his dissenting opinion Judge Hough points out that the proposition "whether a trademark is to be primarily regarded as protecting the trademark owner's business from a species of unfair competition, or protecting the public from imitations," is not yet settled. He thinks the decision in this case leans the wrong way, because it is his opinion that a trademark is primarily a protection to the owner's business.

Continuing, he says that if the primary function of the trademark is to protect this plaintiff's business in his own country, it makes no difference at all that the genuine French article is the thing offered by defendant. That genuine article has become an infringement because the business of dealing in that article within the United States is the plaintiff's business.

Thus there are two federal Circuit Judges holding one way and one federal Circuit Judge and one federal District Judge holding another in this case.

Referred Now to Supreme Court

On a petition for a rehearing the Circuit Court of Appeals denied the petition. This court was asked to certify the question involved to the United States Supreme Court on the ground of its supreme importance in view of the many businesses with their accompanying trademarks of German citizens, bought during the European war by citizens of this country from the Alien Property Custodian. On this occasion the court says it is not doubted that an American citizen may buy the business of a foreigner in the United States, with its accompanying trademarks, and, having done so, may subsequently change the character and quality of the goods at pleasure.

The decisions on one side would open competition in the sale of the trademarked products, a thing usually accorded for the benefit of the public generally; the decision on the other side would tend to create a legal monopoly, a thing abhorrent to the general policy of law. Yet the latter view would tend to greater stabilization of business, in giving certainty to the rights and to the values in marks and names purchased from foreign manufacturers.

Industrial Alcohol for the Chemical Engineer

By James M. Doran
Head, Industrial Alcohol and Chemical Division, Prohibition Unit, Bureau of Internal Revenue

THE chemical engineer or factory superintendent working on a new process or perfecting an old one frequently finds that he needs alcohol for some purpose. It may be that he has been using benzene, ether or acetone as a solvent and finds for reasons of economy, such as minimizing factory losses, obtaining a greater degree of purity or a finer appearance of the product being manufactured, that alcohol will serve his purpose better than other solvents. It may be that in preparing some new organic compound, such as a dye or a pharmaceutical, alcohol is necessary in order to produce and place upon the market the product in commercially paying quantity. Again, the production of some new ethyl ester may open up a new field of profit for the chemical manufacturer.

"How Can I Get Alcohol?"

In all of these contingencies and countless others the question at once arises: "How can I get alcohol? Is there not a high tax on it and does not the national prohibition act make it difficult to obtain without a lot of expense, red tape and endless trouble?" An inquiry is made possibly from some associate or business acquaintance who uses industrial alcohol and in due course of time a copy of the internal revenue regulations is obtained and read over. It looks formidable; maybe it would mean trouble and worry and perhaps not be a good business venture. This is not an unusual experience and in this short article an attempt will be made to explain in as simple terms as possible the operation of the present industrial tax-free alcohol laws as they affect the industrial chemist.

Alcohol, pure or denatured, is the subject of tax laws and governmental regulations in practically every civilized country. The United States in many respects leads other countries in its liberal industrial alcohol laws. Congress has consistently favored and encouraged the use of tax-free industrial alcohol through denaturation provisions from the first denatured alcohol act of June, 1906, down through the national prohibition act now in effect. Under this last-named act the industries of the country using denatured alcohol are amply provided for. In so far as the user of denatured alcohol is concerned, the present regulations drawn under the national prohibition act undoubtedly provide for a more liberal encouragement of industry than regulations in effect before the Eighteenth Amendment became operative. It is safe to say that the attitude of the officials of the Internal Revenue Bureau who administer the national prohibition act was never more friendly to industrial alcohol honestly and legitimately used than at present. So, generally speaking, there is no more red tape, burden or trouble imposed upon the user of alcohol in this country than in any other country. The same governmental regulations are in effect practically everywhere and there is no handicap in that regard peculiar to the United States manufacturer.

Denaturation of alcohol is accomplished generally at the place of manufacture under the supervision of internal revenue officers and in addition the denaturants used are of specified quality and in most cases tested by an authorized chemist before use. Broadly speaking, there are two classes of denatured alcohol: completely denatured alcohol and specially denatured alcohol.

Completely Denatured Alcohol

There are six authorized formulas for completely denatured alcohol. The denaturants used are wood alcohol, benzene, pyridine, kerosene, ether, gasoline, nitrobenzene and orthonitrotoluene. In each of these six formulas there are combinations of one or more of the above denaturants that impart odor and taste and, in addition, make a recovery of potable alcohol from the mixture extremely difficult. The six formulas offer a rather wide range of choice and can be purchased without permit or bond. They are useful for many technical solvent purposes where the added denaturants offer no serious chemical or physical objections. The chief uses are: Fuels; anti-freezing solutions; cleaners; certain grades of shellacs, varnishes and paints; and technical purification processes.

The only restrictions on the use of these formulas are that they be not sold or used for beverage purposes or used for purposes for which tax-free denatured alcohol cannot be lawfully employed. For example, the use of tax-free denatured alcohol is prohibited in any medicinal product for subsequent internal use. If the manufacturer desires to recover completely denatured alcohol incident to any purification process he is required to give a bond to the Collector of Internal Revenue of his district and also register any recovery still employed in the process.

The blended motor fuel of the future will undoubtedly be worked out through the medium of a completely denatured alcohol formula.

Specially Denatured Alcohol

There are seventy authorized formulas for specially denatured alcohol. A number of the more recent ones are applicable to the perfumery industry and certain parts of the pharmaceutical manufacturing industry. It is with the more properly called technical formulas that this article deals.

Application and Bond. To obtain one or more of these special formulas the manufacturer must make an application to the Collector of Internal Revenue of his district, the same officer to whom he pays his income tax. This application states the formulas desired, the products or processes in which they are to be employed and the total quantity in wine, or measured, gallons which will be used in a period of 30 days. If the process involves recovery and re-use of the denatured alcohol, a brief description of the apparatus to be employed must accompany the application. A sample of the product manufactured is required in certain instances and the general formula, if it be a mixture, is frequently necessary. This requirement is in effect in order that the Internal Revenue Bureau may be in a position to determine whether the product or process is one in which tax-free denatured alcohol may be used. The regulations also provide that certain formulas may only be used in a restricted manner and the information set forth in the application is necessary in order to determine these points.

The application must be accompanied by a bond, either a personal bond or a surety bond. The minimum bond that may be filed is $500, which will provide for a purchase and use of not to exceed 99 gal. in a 30-day

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period. Increased quantities of alcohol require increased bonds in the same proportion, but the maximum bond that may be filed is $100,000, under which a manufacturer may use practically an unlimited quantity of specially denatured alcohol, subject to the limitations for its use laid down in the application.

The regulations also provide for a locked storeroom in which the specially denatured alcohol is to be kept before use. This provision is only such as would be complied with by any prudent manufacturer in the storing of articles of value.

The Collector of Internal Revenue transmits these papers to the Treasury Department in Washington, where they are acted upon. If approval can be given, under the law and regulations, to the application, the Collector of Internal Revenue is instructed to issue to the manufacturer a permit to use specially denatured alcohol and a withdrawal permit to procure the required quantity in a period of 30 days from any one or more denaturers or bonded dealers in specially denatured alcohol that the manufacturer may designate.

This permit and bond remain in effect until withdrawn or canceled, for cause, and need not be renewed annually. The manufacturer is required to render to the Collector of Internal Revenue a report at the end of each month which will show the amount of denatured alcohol on hand the first of the month, the amount purchased and received during the month, the amount used in manufacturing and the amount remaining on hand at the end of the month. All of these requirements have been made as simple as possible and still enable the department to have knowledge of the movement of tax-free alcohol.

Principal Formulas and Their Uses

An outline of the principal formulas available, and showing a few of their main uses, will be given merely to indicate the scope of the present authorizations.

First, we have the general solvent formulas. They are:

No. 1 — 100 gal. of ethyl alcohol
5 gal. wood alcohol

No. 3A — 100 gal. of ethyl alcohol
5 gal. pure methyl alcohol

(No. 3A differs from No. 1 only in the degree of purity of the methyl alcohol)

No. 10 — 100 gal. ethyl alcohol
2 gal. methyl alcohol
2 gal. benzene

No. 12A — 100 gal. ethyl alcohol
5 gal. benzene

No. 44 — 100 gal. ethyl alcohol
10 gal. normal butyl alcohol

These formulas are widely used in shellacs, varnishes and extraction processes. They have been authorized for over a thousand specific products and it will be necessary to refer to Internal Revenue Regulations No. 61 for the details showing their wide application.

Formula 2B (100 gal. ethyl alcohol and ½ gal. benzene) is widely used as a solvent for nitrocellulose products embracing the manufacture of smokeless powder, artificial silk, artificial ivory and pyroxylin plastics. This formula is restricted as to the uses which will be permitted and this is one of the cases where the manufacturer is required to submit some additional detail as to his process and apparatus.

Formula 13A (100 gal. ethyl alcohol and 10 gal. ether) is used in the manufacture of ether. It also has considerable application as a purifying and recrystallizing medium for certain organic compounds and dyes.

Formula 4 (100 gal. of ethyl alcohol and 1 gal. of a 40 per cent nicotine solution with added coloring matter) is widely used in tobacco products, such as the manufacture of cigars, smoking tobacco, etc.

Formulas No. 5 — 100 gal. ethyl alcohol
65 lb. sulphuric ether
3 lb. cadmium iodide
3 lb. ammonium iodide

No. 11 — 100 gal. ethyl alcohol
100 lb. sulphuric ether
10 lb. cadmium iodide

and No. 19 — 100 gal. ethyl alcohol
100 gal. ethyl ether

are principally used in the photo-engraving industry as carriers or vehicles for sensitized collodion.

Formula No. 18 — 100 gal. ethyl alcohol
100 gal. vinegar containing not less than 9 per cent acetic acid

No. 21 — 100 gal. ethyl alcohol
100 gal. of a solution containing not less than 4½ per cent acetic acid

are used for the manufacture of vinegar, acetates and acetaldehyde.

Formula 20 (100 gal. ethyl alcohol and 5 gal. crude chloroform of a specific gravity not less than 1,400 at 25 deg. C.) is used in the manufacture of chloroform.

Formula 30 (100 gal. ethyl alcohol and 10 gal. of pure methyl alcohol) is used for analytical laboratory purposes.

There are many formulas available for toilet articles and external pharmaceutical preparations, but the reader will have to be referred again to Internal Revenue Regulations No. 61 for the details, as they are too extensive for this article. These formulas are available for the manufacture of lotions and liniments, tincture of iodine, tooth pastes, dentifrices, toilet waters and perfumes. They are of interest chiefly to the pharmaceutical and perfumery industries.

It is not possible to cover the many thousands of authorized uses of denatured alcohol, but a manufacturer who is unable to obtain the information necessary from the Regulations is urged to communicate with the department. New processes are being continually developed that make it desirable for other formulas to be authorized. Data are continually being assembled showing the need of the modification of some of the present formulas.

The Treasury Department is very much interested in obtaining all the information and suggestions possible that will enable it to administer these provisions of the national prohibition act with the greatest possible benefit to industry.

What Is a Chemical Engineer?

At a meeting of the Provisional Committee for the formation of a British Institution of Chemical Engineers the following definition was agreed upon: "The chemical engineer is a professional man experienced in the design, construction and operation of plant in which materials undergo chemical or physical change."

Fundamental Physical and Chemical Properties of Commercial Lime I—The Available Lime Content

The First of a Series of Articles Describing the Experimental Work in the Laboratories of the National Lime Association—Variations in Available Lime Content and Their Significance

By M. L. Holmes and G. J. Fink
Chemical Department, National Lime Association

THE extensive ramification of the uses of lime[1] in our industrial life and the enormous increase during recent years in the use of lime[2] by the chemical industries and in technical processes have served to show the lack and to emphasize the urgent need of comprehensive information about the fundamental physical and chemical properties of this material. Before the most intelligent use can be made of such a chemical as lime we must first know its properties and how it will function.

The National Lime Association undertakes to serve the user of lime in every possible way and in accordance with that policy has under way an extensive investigation in which limes from every section of the country are being studied for the purpose of obtaining, upon one set of samples, comparative data on all of the important characteristics of this material. This work should have an important bearing upon every industrial use of lime.

Although there may be abundant data concerning the chemically pure oxides and hydroxides of calcium and magnesium, there are very little published data on the commercial limes as now found on the market. By the term commercial lime, we refer to the three and one-half million tons of product made yearly in this country by calcining limestone and which is placed on the market without any further processes of chemical purification. That this material may be quite different from corresponding c.p. chemicals is evident from the following definitions as adopted by the American Society for Testing Materials:[3]

"Quicklime is a calcined material, the major part of which is calcium oxide or calcium oxide in natural association with a lesser amount of magnesium oxide capable of slaking with water.

"Hydrated lime is a dry powder made by treating quicklime with enough water to satisfy its chemical affinity under the condition of its hydration. It consists essentially of calcium hydroxide or a mixture of calcium hydroxide and magnesium oxide and magnesium hydroxide."

Commercial limes are further classified by the A.S.T.M. on the basis of the alkaline-earth oxide ratio as calcium and magnesium limes. In common practice calcium lime is one containing 85 per cent or more total CaO and magnesium lime is one containing more than 10 per cent MgO. In case the CaO content is very high, it may be called high-calcium lime and in case the magnesium oxide is considerably more than 10 per cent it may be called high-magnesium lime.

Method of Manufacture

Most of the quicklime produced in this country is made in shaft kilns in which the selected limestone is subjected to the temperature of the decomposition of calcium carbonate for a time sufficient to drive off all the carbon dioxide. Details of the precautions observed in producing a high-grade material of uniform quality may be found in previous publications.[4]

Hydrated lime is now made by mechanical processes which vary somewhat, but all involve the thorough mixing of the quicklime with the predetermined quantity of water required for complete hydration and the maintenance of the most favorable conditions for such hydration. The actual process of hydration is followed by storage and mechanical purification such as air separation or screening. Further details are given in the above-mentioned references.

TABLE I—LOSS ON IGNITION AND AVAILABLE LIME CONTENT OF COMMERCIAL QUICKLIME

N.L.A. Quicklime No.	Per Cent Loss on Ignition	Per Cent Available Lime (Non-Volatile Basis)	N.L.A. Quicklime No.	Per Cent Loss on Ignition	Per Cent Available Lime (Non-Volatile Basis)
2	0.70	94.02	63	0.32	90.15
3	0.95	90.12	64	2.69	95.87
4x	0.75	94.00	65	1.18	48.98
4y	0.82	95.78	66	4.64	77.62
5	0.64	96.44	69	2.65	60.35
6	0.62	95.47	71	0.52	53.73
7	1.27	91.36	72	2.64	86.17
9	0.12	80.54	73	0.56	84.22
10	0.16	89.77	74	0.55	51.77
12	0.55	88.12	75	0.74	59.45
17	0.31	89.91	76	1.00	93.18
18	0.38	86.12	78	0.88	91.30
22	1.09	87.32	79	0.55	90.51
23	1.22	54.91	81	0.71	87.03
25	0.59	81.63	82	0.57	77.44
26	0.70	96.42	85	0.44	88.58
27	0.65	93.19	86	0.64	77.79
28	0.72	93.57	87	0.90	94.00
34	0.53	88.93	89	0.95	92.95
35x	4.32	93.12	92	0.84	55.35
37	0.48	89.73	93	1.17	93.88
37x	0.48	94.69	94	0.72	92.43
38	0.48	96.27	95	1.21	97.53
40	0.68	48.45	96	0.52	93.71
41	0.68	82.43	102	1.97	93.13
42	0.61	82.85	103	0.85	55.35
44	0.66	91.95	105	0.76	80.51
45	0.46	83.88	107	0.72	87.09
46	0.34	90.45	109	0.34	94.87
47	0.44	92.00	111	0.73	66.33
49	0.45	90.45	112	0.36	53.59
51	0.72	92.81	115	0.53	55.64
52	1.78	55.18	117	0.58	54.21
53	11.67	33.42	118	0.87	53.08
57	0.95	88.23	119	0.66	47.56
59x	0.52	95.33	121	0.88	50.24
59v	0.60	92.29	125	0.80	50.15
62	0.50	88.49	127	1.01	88.54

Samples Used in These Investigations and Handling

The samples of lime used in these investigations were obtained from lime plants located in practically all sections of the country and representing all types of lime varying widely in physical properties and ranging in chemical composition from the high-calcium to the high-magnesium type. The samples represent the average quality furnished continuously to the trade by these companies.

The samples were received and stored in airtight tin cans, each being assigned a key number.

The quicklimes were crushed to pass a quarter-mesh sieve and samples for all determinations were obtained by quartering in the usual manner as specified by the

[1] *Chem. & Met. Eng.*, vol. 26, p. 294 (1922).

[2] National Lime Association Lime Brief No. 252.

[3] 1922 Report of Committee C-7 of the American Society of Testing Materials.

[4] *Chemical Age*, vol. 29 p. 227 (1921), "Manufacture of Lime." N.L.A. Lime Brief 250, "Outline of the Process of Lime Manufacture." Bureau of Standards Technologic Paper 16.

TABLE II—LOSS ON IGNITION AND AVAILABLE LIME CONTENT OF COMMERCIAL HYDRATED LIMES

N.L.A. Hydrated Lime No.	Loss on Ignition, Per Cent	Available Lime (Non-Volatile Basis), Per Cent
2a	24.10	85.63
3a	24.06	82.61
5a	24.84	89.44
21a	23.22	82.50
23a	19.18	52.91
25a	21.02	77.75
27a	24.46	91.34
35xa	24.32	90.84
38a	21.66	77.37
39a	23.96	79.06
45a	21.72	68.52
46a	23.98	78.36
47a	24.84	89.47
51a	24.88	82.24
52a	17.74	44.15
58a	23.74	83.71
59a	24.66	90.16
63a	23.84	82.90
65a	18.78	48.59
71a	16.64	51.01
72a	18.80	60.20
73a	24.90	75.65
74a	19.42	49.55
75a	19.60	58.35
78a	23.64	73.11
79a	24.48	87.73
81a	23.76	83.03
86a	24.66	90.29
87a	24.24	80.70
88a	28.00	19.54
93a	23.46	77.57
94a	24.46	80.12
96a	22.86	80.14
98a	16.58	53.06
99a	16.66	51.11
101a	27.28	71.87
103a	17.92	48.25
105a	19.62	49.70
107a	25.42	76.24
120a	15.36	45.95

A.S.T.M. The hydrated limes were quartered directly to obtain a sample of proper size for each determination.

The hydrated lime samples were not made from the particular samples of quicklime used in these tests, but the hydrated lime and quicklime designated by the same key number were obtained from the same plant and are products of the same quarry.

The condition of these samples as tested is indicated by the low loss on ignition as given in Table I of this paper, showing that the samples were in good condition when tested.

The results of these investigations will be reported in a series of articles, of which this, on the available lime content, is the first. The series will include papers on specific gravity, per cent pore space, rate of settling, volume in water, fineness, slaking characteristics, volume, weight and water content of putty, plasticity, sand-carrying capacity, colloidal properties, optical properties, chemical reactivity toward solutions, solids and gases, chemical composition, etc. The interrelationship of these various properties will be pointed out as they are taken up and a final article will summarize all of the data.

TABLE III—CALCIUM LIMES

N.L.A. Lime No.	Available Lime—Quicklime	Available Lime—Hydrate	Difference	Per Cent Difference
2	94.02	85.63	8.39	8.92
3	90.12	82.61	7.51	8.33
5	96.44	89.44	7.00	7.25
25	81.63	77.75	3.88	4.75
27	93.19	91.34	1.85	1.98
35x	93.12	90.84	2.28	2.45
38	96.27	77.37	18.90	19.63
45	83.88	68.52	15.36	18.31
46	90.45	78.36	12.09	13.36
47	92.00	89.47	2.53	2.75
51	92.81	82.24	10.57	11.38
59x	95.33	90.16	5.17	5.42
63	90.15	82.90	7.25	8.04
72	86.17	60.20	25.97	30.14
73	84.22	75.65	8.57	10.17
78	91.30	73.11	18.19	19.92
79	90.51	87.73	2.78	3.07
81	87.03	83.03	4.00	4.59
86	77.79	90.29	−12.50	−16.07
87	94.00	80.70	13.30	14.15
93	93.88	77.57	16.31	17.37
94	92.43	80.12	12.31	13.31
96	93.71	80.14	13.57	14.48
107	87.09	76.24	10.85	12.45
Average	90.31	81.31	9.01	9.84

I. The Available Lime Content

During recent years it has become more and more the practice to base specifications for lime for certain uses upon the available lime content, although there seems to have been very little information bearing directly upon this property of commercial lime. This investigation was undertaken to supply this much-needed information, having in mind particularly the relative amounts of available lime in quicklime and hydrated lime on the one hand and calcium and magnesium limes on the other hand.

By the term available lime is meant that portion of the total oxide content of the lime, either quicklime or hydrated lime, calculated as CaO, which is easily soluble in water and is thus available as a source of hydroxyl ions. All figures for available lime are expressed in terms of percentage of the non-volatile portion.

After considering the various methods which have been proposed for determining available lime, it was decided to use the Bureau of Standards modification of the Scaife method,[5] recently adopted by the American Society for Testing Materials, which is quoted as follows:

"Place 1.4 grams of the carefully prepared and finely ground (passing 100 mesh) lime in a 400-c.c. beaker, and 200 c.c. of hot water, cover, heat carefully and then boil for 3 minutes.

TABLE IV—MAGNESIUM LIMES

N.L.A. Lime No.	Available Lime—Quicklime	Available Lime—Hydrate	Difference	Per Cent Difference
23	54.91	52.91	2.00	3.64
52	55.18	44.15	11.03	19.98
65	48.98	48.59	0.39	0.80
71	53.73	51.01	2.72	5.62
74	51.77	49.55	2.22	4.28
75	59.45	58.35	1.10	1.85
103	55.35	48.25	7.10	12.79
Average	54.19	50.40	3.79	6.99

"Cool, wash down cover, add two drops of phenolpthalein and titrate with *N* hydrochloric acid, adding the acid dropwise as rapidly as possible and stirring vigorously to avoid local excess of acid. When the pink color disappears in streaks, retard the rate of addition of acid somewhat, but continue until the pink color disappears entirely and does not reappear for 1 or 2 seconds. Note the reading and ignore the return of color.

"Repeat the experiment, substituting for the 400-c.c. beaker a 1-liter graduated flask carrying a one-hole stopper fitted with a short glass tube drawn out to a point. Cool and add dropwise and with vigorous stirring 5 c.c. less acid than before. Call the number of c.c. used *A*. Grind up any small lumps with a glass rod flattened at one end, dilute to the mark with freshly boiled distilled water, close the flask with a solid stopper, mix thorougly for 4 or 5 minutes and let settle for half an hour.

"Pipette a 200-c.c. portion, add phenolphthalein, and titrate slowly with 0.5 *N* hydrochloric acid until the solution remains colorless on standing 1 minute. Call this additional number of c.c. *B*. Then the percentage of available CaO equals $2A + 5B$."

The available lime data tabulated in Tables II, III

[5] *Chem. & Met. Eng.*, vol. 25, p. 740 (1921).

and IV are recalculated to the non-volatile basis, by application of the following formula:

$$\text{Percentage available lime on non-volatile basis} = \frac{\text{Percentage available lime in samples as used}}{100 - \text{loss on ignition}}$$

The figures therefore represent the percentage of the non-volatile portion of the sample, which is water-soluble under the conditions as described.

In Table I are given the data obtained on commercial quicklimes and in Table II the corresponding data for hydrated limes. In Table III is given the available lime content of typical calcium quicklimes in their corresponding hydrates, and in Table IV similar data are given for typical magnesium limes.

Discussion and Conclusions

The data in Table I show that there is a large variation in the available lime content of commercial quicklimes and that in a few special instances it is possible to obtain at the plant where made a lime running as high in available lime as 96 per cent of the non-volatile portion.

The data in Table II show a variation for hydrated limes similar to that in Table I with certain hydrates running somewhat higher than 90 per cent.

It is evident from the data in Tables III and IV that calcium limes have a much higher available lime content than magnesium limes and on the other hand that the reduction in available lime content by the hydration of magnesium limes is less than that of calcium limes.

It is also evident from the averages in Tables III and IV that the tendency for the quicklimes, both calcium and magnesium, is to have a higher available lime content than the corresponding hydrates as determined by the A.S.T.M. method. This difference is not large and is insufficient to outweigh the obvious advantages of hydrate for certain purposes. It is, however, consistent enough to warrant the conclusion that certain conditions obtain in modern mechanical processes of hydration which tend to reduce the available lime content. The data for several of the samples, on the other hand, show that it is possible to hydrate so as greatly to minimize this tendency.

There are several causes which may possibly contribute to a reduction in the available lime content during the process of mechanical hydration and mechanical treatment. These causes may be chemical or they may be physical. It has been suggested that it may be a case of molecular aggregation whereby a portion of the lime is rendered physically unavailable, or it may be a case of molecular transformation by local burning during hydration which might change some of the lime into a less soluble form. The state of moisture and local temperatures in the hydrator may also be conducive to certain chemical reactions between the constituents in the lime which would produce a small percentage of an insoluble product. Further work to be reported later will add more information on this subject.

Protection of Aluminum

Much work has been done in recent months by the corrosion committee of the British Institute of Metals on the preparation and testing of protective coatings of molybdenum compounds and aluminum hydroxide for use in aluminum and light alloys. This work is still in progress, and will eventually be published.

Etching to Develop Overstrain

An etching process originated by A. Fry, of Krupp's research laboratory, Essen, Germany, develops new markings in overstrained steel bearing close relations to lines of maximum shear as determined mathematically.[1] Fig. 1 gives the appearance at natural size of a piece of boiler plate, bent flat upon itself cold.

Specimens are prepared for microscopic or macroscopic examination in the usual manner, care being taken particularly to avoid any distortion of the specimen during grinding and polishing. Before examination they must be "suitably" reheated, ½ hour at 200 deg. C. being suggested.

For microscopic investigation the etching medium is prepared as follows: Concentrated HCl 400 c.c., H_2O 30 c.c., ethyl alcohol 25 c.c., cupric chloride crystals 5 grams. The carefully polished specimen is etched briefly and if necessary repolished and re-etched until the desired results are obtained. The etching medium

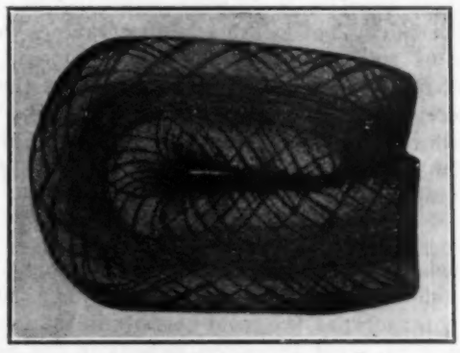


FIG. 1—PIECE OF BOILER PLATE, BENT FLAT UPON ITSELF COLD

for macroscopic investigations consists of concentrated HCl 120 c.c., H_2O 100 c.c., cupric chloride crystals, 90 g.

The specimen is immersed in this solution for from 1 to 3 minutes, then removed and rubbed with finely pulverized cupric chloride on a rag moistened with the etching medium until the desired contrast is maintained. The specimen is then dried without rinsing, washed with ethyl alcohol and then thoroughly dried.

Both solutions are too strongly acid to deposit copper upon the iron. The etched pattern should consist of dark and light bands, the dark color being ascribed by Fry to the formation of iron hydride. These bands correspond to the location of maximum shearing stresses in the material and by their presence indicate how much of the material has received cold-work—that is, has been plastically deformed.

List of Petroleum Laboratories Being Compiled

A list of commercial laboratories specializing in the analysis of petroleum products is being compiled by the United States Bureau of Mines. Laboratories are being asked to indicate the particular tests outlined in Technical Paper 298, "Methods of Testing Petroleum Products," which they are prepared to perform. Inquiry is being made especially as to whether laboratories are equipped (1) to make analyses of natural gas, especially the determination of gasoline content, (2) to examine crude oils, oil shales and oil sands, and (3) to undertake petroleum problems of a research nature.

[1] *Stahl und Eisen*, 1921, p. 1093. See also "Forging and Heat-Treating," 1922, p. 99.

Pouring Sound Ingots of Fine Steel*

Americans Teem Cool Steel in Bottom-Cast Ingots—Surface Cracks Controlled by Shape and Condition of Mold—Pipe Reduced by Retaining Hot Metal in Ingot Top and Slow Cooling—Ingot Should Be Stripped Fairly Early and Buried in Ashes

ON PAGE 929 of *Chemical & Metallurgical Engineering* for May 17, 1922, was presented an article on "Fine Steels From the Acid Open Hearth," wherein was explained in detail the method of making fine nickel steel and getting it into the ladle at the proper temperature. The present article is a continuation of the subject matter, and deals with the proper procedure to convert the liquid steel into sound ingots.

American practice is to pour large ingots of nickel steel with fairly cool metal, avoiding surface cracks at the risk of retaining inclusions in the metal. Europeans purposely pour very hot, holding that the advantages accruing to the method counteract the surface cracks which form; cracks which can be chipped out and which are regarded by the workmen as signs of a quality ingot.

Surface Cracks

Hot metal entering a cold mold is chilled and a crust rapidly solidifies, thicker at the bottom. As this crust cools it contracts; as the mold heats it in turn expands; the solidifying ingot therefore loosens in the mold and loses its outside support. If the steel is poured so rapidly or so hot that the crust grows more slowly than necessary to resist the interior pressure of liquid metal, it will burst. To avoid this, American metallurgists pour "cold" and slow. Surface cracks are also affected by the condition and shape of the molds, as will be shown later.

However, if pouring is too slow, the top edges of the steel may crust over, and this crust may be folded back against the mold as the level rises; it either remains unmelted or is remelted; if the former, it forms a scab which must be cut out; if melted, it puts oxidized iron into the ingot. Spittings and splashings from the ladle stream striking and sticking to the mold are sources of similar defects in top-poured ingots.

Cold pouring, on the other hand, certainly retains in the ingot any inclusions which the steel possessed on being tapped from the furnace or picked up subsequently from its containers. Large ingots which will not surface crack must be poured in the mushy stage (where the metal consists of low-carbon austenite crystals growing from a higher carbon mother liquor), a state which does not permit many lighter solids to rise to the surface. An obvious corrective is to make clean steel and handle in clean containers.

Hot-poured metal solidifies slowly and causes columnar crystallization in the outer layers of steel, a condition known as "scorched," and to Europeans not especially disliked, except that such an ingot is quite tender under forging.

If a prism of metal could be cooled so that the temperature was the same, surface to axis, it would solidify into a denser mass, without internal cavities. But ingots freeze from the outside in, and from the bottom up. Consequently the interior may be still molten when the shell is relatively cold and fairly rigid. As the whole mass continues to cool, the outer zones also cool and contract, but their contraction is not as great as demanded by the contraction to be endured by the hotter inner zones. What results is a mass of compressed metal toward the surface, gradually changing through a zone practically unstrained into a mass of interior metal strained in tension. If at any time—even long after the entire mass has solidified—the inner material is stretched beyond its resisting ability, a cavity opens up, immediately closed by (in fact anticipated by) hotter metal sagging into place if the temperature is high enough to allow viscous or plastic flow under the force of gravity. Otherwise a permanent cavity or pipe remains. Evidently it is necessary to feed the interior portions of the ingot with hotter metal to the very last if the pipe is to be restrained. Other things being equal, this is better done in big ingots than in small.

Hot Tops

Various well-known devices are used to keep the top of a solidifying ingot hot. Among these are "hot-tops" to the molds; sinkheads; placing the large end of the ingots uppermost; pouring slowly at a low temperature, and at the top of the ingot (especially at the last); and making the mold walls thicker below than above so that they may cool the bottom of the ingot faster than the top. Fig. 1 gives details of this practice. Lagging the upper part of the mold with insulating material also helps retain the necessary heat at this region.

Sink-heads of sand are likely to be the source of many inclusions if the ingot is top cast. Tops kept hot by coke or charcoal fires will be carburized and this extra carbon is likely to be carried down to considerable depths by diffusion or feeding.

Eventually from 20 to 30 per cent of the steel will be discarded from the top, as being fundamentally unsound from pipe, or containing segregated impurities (sulphur and phosphorus). The lower figure is sufficient for well-made thoroughly deoxidized clean steels properly cast with hot tops.

Since steel cools more rapidly in the mold than in the ladle, slow top pouring *shortens* the pipe by furnishing liquid metal to the top long after the metal in the base has chilled. For the same reason, cold pouring *raises* the pipe. Suppose the extreme case where metal would solidify almost immediately on entering the mold. This approximates the condition of uniform cooling, and tendency to pipe is eliminated because there is small difference in temperature, sides to axis, and consequently small difference in the internal stresses.

Molds should taper just enough so that the ingots can be stripped easily when the faces are at about 850

*A digest of a paper entitled "Acid Open-Hearth Process for Manufacture of Gun Steels and Fine Steels," presented by W. P. Barba and Henry M. Howe before the February meeting of the American Institute of Mining and Metallurgical Engineers.

deg. C. (1,560 deg. F.) and the corners black. Any excess taper causes difficulties when attempting to reheat an ingot uniformly, and usually involves extra work in forging. Simultaneous contraction of the cooling ingot and expansion of the heating mold might be expected to leave a gap between the two, even with no taper. But much of the contraction is counteracted by the internal ferrostatic pressure. Furthermore, the mold is not truly smooth, even though it is carefully prepared, coated with a graphite wash and polished. Diminishing the diameter $\frac{1}{16}$ in. to the running foot is good practice, for both large and small ingots. The extra contraction in a large ingot (resulting from its higher average temperature when the outer layer is somewhat rigid) would lead one to expect that it could be poured in a mold with a somewhat slighter taper. But this extra contraction seems to be restrained by extra internal resistance.

If a round gutter pipe is filled with water and frozen it will burst. If a fluted gutter pipe is treated similarly, the curved sides buckle a little and do not burst. For similar reasons, ingots are fluted to prevent longitudinal surface cracks.

Transverse cracks are often caused by the top of the ingot being hung from the mold by a fin or by some roughness before the sides are cold and strong enough to bear the weight of the metal below. Conditions are aggravated, of course, if the metal is seized and held fast at both ends. Slightly protruding corners on the ingot are of advantage in counteracting these cracks, since they cool more rapidly and quickly form solid pillars to support the weaker portions.

A fluted octagon seems to be the best cross-section. It possesses eight protruding corners, protruding enough to cool somewhat quicker than the faces, and yet not enough to fold over when being forged or to be burned during reheating. To avoid this last contingency a square ingot must have rounded corners, but even so, there is a pronounced tendency to develop diagonal planes of weakness corresponding to the junction of columnar crystals growing in from adjacent sides, a tendency which is counteracted in part by thinning the mold, as shown in Fig. 2. Square ingots designed for rolling are shaped in this fashion to facilitate blooming and manipulation; forging ingots are frequently made with convex sides.

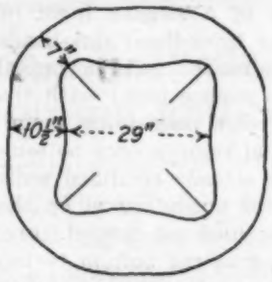


FIG. 2—ROUNDING AND THINNING THE EDGE OF A SQUARE MOLD

The ratio of length to thickness for ingots of tender alloy and high-carbon steels is approximately as follows:

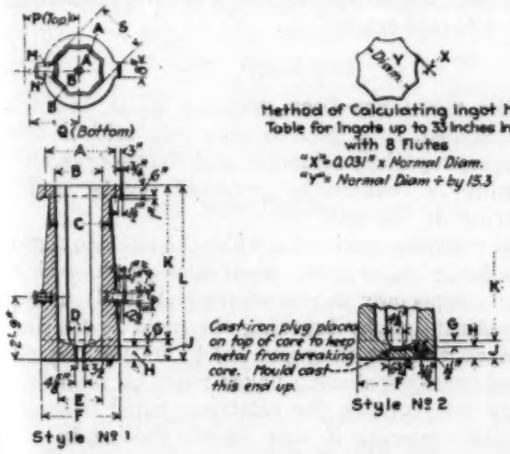
Size	Length ÷ Diameter	Size	Length ÷ Diameter
4 in.	Up to 9	40 in.	Not more than 2½
18 in.	3.5 to 5	60 in.	Not more than 1¾

If the 40- and 60-in. ingots are intended for shafts, the length may be increased somewhat beyond these ratios, because inclusions are not so harmful in shafting as in guns.

Top Versus Bottom Pouring

Though bottom pouring requires more apparatus, more equipment and more time for setting up than is usual for top pouring, it has the greatest outstanding advantage that each individual ingot can be watched during its making, and the speed of the incoming stream of metal adjusted in exact conformity with the requirements of the temperature and composition of the metal and the size and shape of the mold. These and all the other factors governing the production of a successful ingot are found to be under much more thorough observation and control in bottom pouring than has as yet been possible in top pouring, except when pouring from a lip or teeming through a head box.

The disadvantages attending bottom pouring, noted above, together with the prohibitive proportion of scrap metal from runners, cause small crucible-steel ingots to be top poured; larger ingots of fine steel from 9 to 55 in. in diameter and weighing up to 150,000 lb. are bottom poured, often in groups from a central gate, thus giving great uniformity among small ingots of a given lot. Still larger ingots, especially when very high and requiring more than one ladle of metal, are half or one-third bottom poured, and the upper part teemed from above. In the latter case, the pool already formed prevents splashing and scouring against the bottom of the mold, a great drawback to top pouring any but the shortest ingots. Furthermore, the surface of large or wide ingots may be observed even when top pouring, and its indications are not so much disturbed by the impact



MARK	NOMINAL SIZE OF INGOT	MOULD DIMENSIONS																	S		AREA OF MOULD SECTION		AREA OF MOULD WALL		MEAN WT. OF INGOT PER INCH OF LENGTH	MAX LENGTH OF USEABLE BODY OF COLD INGOT
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R		TOP	BASE	TOP	BOTTOM	TOP	BOTTOM		
A	10"	22"	10⅛"	18"	4"	9¼"	22"	2"	7"	9"	72"	81"	6"	4½"	11⅛"	9⅛"	⅞"		11⅛"	10⅛"	955 sq. in.	785 sq. in.	1605 sq. in.	302 sq. in.	24 lbs.	68"
B	13"	25"	13½"	21"	4"	12½"	25"	2"	7"	9"	72"	81"	7½"	6¼"	14"	12⅛"	1"		15⅛"	14⅛"	1100 "	1370 "	1860 "	3630 "	40 "	68"
C	14"	26"	14½"	22"	4"	13½"	26"	2"	7"	9"	72"	81"	8⅛"	7½"	15"	14⅛"	1"		16⅛"	15⅛"	1880 "	1600 "	2000 "	3700 "	47 "	68"
D	16"	28"	16⅛"	24"	5"	15⅛"	28"	2"	7"	9"	72"	81"	9⅛"	8⅛"	17⅛"	16⅛"	1"		18¾"	17⅛"	2360 "	2100 "	2160 "	4050 "	60 "	68"
E	18"	31"	19"	27"	5"	18"	31"	2"	7"	9"	72"	81"	10"	9⅛"	21⅛"	20⅛"	1⅛"		21¾"	20⅛"	3150 "	2820 "	2570 "	4720 "	83 "	68"
F	20"	35"	20⅛"	31"	5"	19⅛"	34"	2"	7"	9"	72"	81"	11⅛"	9⅛"	24⅛"	18⅛"	1⅛"		23¼"	22⅛"	3680 "	3330 "	3880 "	5750 "	96 "	68"
G	23"	38"	23⅛"	33⅛"	5"	22⅛"	40"	2⅛"	7"	9⅛"	74"	83⅛"	11⅛"	11⅛"	25⅛"	22⅛"	1⅛"		26¼"	25⅛"	4830 "	4430 "	3980 "	8130 "	130 "	68"
H	30"	48"	31"	44"	7"	29"	48"	3½"	7"	10⅛"	78"	88⅛"	17⅛"	15"	32⅛"	29"	2"		35⅛"	33⅛"	8340 "	7350 "	5180 "	10740 "	218 "	72"

FIG. 1—DIMENSIONS OF MOLDS THICKENED AT BASE AND THINNED AT TOP

of the metal. Lastly, the top of a slender ingot of any weight or of a mold having brick-lined sink-heads should be filled from above, because this puts hot metal directly where it is needed (to reduce pipe) with the minimum disturbance to the cooler underlying metal. In fact the churning of the axial regions of a bottom-poured ingot hemmed in by the already solidified walls leaves behind an inverted cone of mushy metal up the axis of an ingot of practically uniform temperature. An entire lack of temperature gradient bottom to top would produce a deep pipe because the fissured lower metal is not overlain by hotter, more plastic metal which can sag into the cavity. Fortunately temperature uniformity does not persist long after pouring has ceased in large ingots, on account of the much slower solidification of the upper part of the inverted cone of fluid metal.

If the requisite degree of care is given to the selection of the brickmaker, the material from which the bricks are made, the nature and the burning of the bricks, and the care with which they are fitted together into gates and runners and the joints protected, it will be found that there is only a negligible amount of inclusions due to fluxing of the inner surface of the bricks by the stream of metal entering the molds.

Very high molds are sometimes spoiled by "run outs." In every case great care must be taken to insure that the passageways are stout enough not to be burst by the internal pressure. During the top pouring of the last portions of very high ingots, however, the runners used at the start freeze and effectually prevent leakage from the mold.

Precautions During Pouring

Metal near the ladle stopper is chilled and often contains inclusions. Therefore about 400 lb. of steel is first teemed to scrap, the stopper carefully closed, the ladle centered over the regular mold, and teeming started as soon as possible. The top hole, stopper plug and lining of the ladle bottom should be as refractory to the scour of rushing metal as possible, for fluxing of these parts is a fruitful source of non-metallic inclusions in fine steel.

The interval between tapping and teeming and the rapidity of teeming are governed by the melter's judgment as to the temperature at which the steel left the furnace, and by the size and number of ingots into which the charge in the ladle is to be poured. The length of time occupied in teeming each ingot should be recorded carefully for the melter's guidance in future cases. If today's ingots show external cracks and are tender to forge, he will infer that he should pour a little cooler. If on the other hand, laps, scabs and cold shuts show, especially at the corners, the ingot was poured a little too cool. Another source of information is the condition of the ladle after pouring. A slight skull should remain after cold pouring, representing material too pasty—too near the solidus—to flow to the nozzle. Rate of pouring and temperatures are therefore regulated by the melter's judgment, skill and experience with former ingots and heats.

The above indications are derived from conditions existing after the job is done, and any trouble can be corrected only in future casts. The most important evidence *during* the casting is the appearance of the top of the metal in the mold. It is a common saying that the appearance of bottom-poured steel as it rises in the mold should be that of "breaking cream." This is readily understood when we remember that the metal poured at the proper temperature is an emulsion much like that of the suspended butter fat of thick cream. Both are subject to crusting over with a very thin crust. In steel, this crust, caused by the cooling effect of the air in the neighborhood of the mold, is quickly remelted by the hot steel rising from below if the pouring temperature is proper.

If cold pouring is stopped, even for a very short time, a defect known as a "stop pour" forms where the upper surface slightly freezes, oxidizes and is not remelted. This defect extends into the metal an unknown depth. Stop pours are fit cause for rejection in gun steels, and in other fine steels the ingot should be sheared at the defect. Slight stop pours may not be detectable in the ingot, and are often glossed over in rolling, showing up only when machining starts. Forging is more likely to make them evident.

Stripping, Cooling and Reheating

As soon as the solid walls have grown thick and strong enough to support the interior fluid safely, the molds are stripped. Removal of this "chill" causes the surface to cool at a slower rate, the temperature gradient, surface to axis, becomes less and the pipe-forming tendency is therefore reduced. Liability to internal and external cracks is also decreased. Further retardation in cooling may be had by burial in ashes or bituminous coal; still slower cooling in soaking pits passes to another danger—viz., growth of very large primary crystals. Top-poured ingots may advantageously be stripped somewhat earlier than bottom-poured, and permitted to cool in the air until the solidification of the wall has progressed to such a point that the outer surfaces are under a fairly high stress. They should then be buried. Such practice safely expedites the cooling.

Reheating of ingots and blooms of fine steel should be done extremely slowly, so that differential expansion caused by one zone or region being hotter than its neighbors may not strain the metal beyond its strength and cause internal cracks.

Summary

After the metal has been properly made and thoroughly degasified, it is poured relatively cold in order to restrain segregation, columnar and coarse crystallization. Piping is reduced by inverted ingots, and by rapid pouring at the end.

External cracking, occurring when the surface regions are just solidifying, or later when passing through the "blue heat" (especially in coarse-grained steel), may be guarded against (*a*) by tapering the mold so the ingot will free itself and not hang and (*b*) by fluting the mold.

"Internal cracks including flakes must be restrained:

(*a*) "By interrupting the relatively rapid cooling in the mold and replacing it with slower cooling in ashes as soon as the ingot has solidified sufficiently to be moved without danger of cracking.

(*b*) "By saddening (giving a succession of light reductions under the hammer or press, or in a rolling mill) and thereby substituting strong cohesion and toughness for its initial fragility due to its having a very coarse crystalline sugar-like structure.

(*c*) "By retarding the heating of the ingot for forging and that of the forgings themselves, so as to lessen the thermal stresses.

(*d*) "By as great freedom from inclusions as possible."

The Technology of the Carbon-Electrode Industry—VI Cleaning, Testing, Machining and Shipping

In Concluding This Series of Articles the Author Reviews the Finishing Steps in Electrode Manufacture and Discusses the Properties and Other Factors Affecting Requirements for Use in Electrolytic and Electrothermic Applications—Economics of the Industry and the Trend of Developments

By Charles L. Mantell
Division of Industrial Chemical Engineering, Pratt Institute, Brooklyn, N. Y.

In the articles which have preceded this one the discussion of carbon-electrode manufacture has been carried through the baking process.* The green electrodes, which are made of a combination of carbonaceous materials, the properties and qualities of which vary widely with temperature changes and which have a high electrical resistance and a low tensile strength, have now been changed into baked electrodes, consisting of material with uniform properties over a wide temperature range and with lower electrical resistance and higher tensile strength than the green electrode.

The electrodes as they come from the baking furnaces are dirty—that is, they have adhering to their surfaces some of the packing material in which they were baked. In the case of carbons with which a correctly graded packing material was used, most of the packing dust can be easily removed by knocking or brushing. Sometimes, however, cases of carelessness occur when use has been made of a low fusing packing dust, high in ash content. As a result, large lumps of packing material are attached to the surfaces of the carbons and are removed only with difficulty. At other times sufficient care may not have been taken in placing packing between all of the surfaces of the carbons when loading the furnace. The result is that when the carbons are softened in the early stages of baking, they become welded together and when baked in this manner give malformed electrodes. These, of course, go to the scrap pile.

The Methods of Cleaning

Methods of cleaning differ according to the shape of the finished electrode. They may be divided into three general methods—(1) brushing, (2) stoning and (3) tumbling. Although the method used depends primarily upon the shape or form of the finished electrode the amount of packing material to be removed must be adjudged a factor of secondary importance. Plates, of course, could not be tumbled in a tumbling barrel without an excessive breakage loss. The same holds true for long, small-diameter electrodes. Electrodes with square or rectangular cross-section cannot be tumbled, as their edges would be rounded off as a result of the process.

Usually two or all three methods are employed in conjunction with one another. Carbons as they come from the furnace are sent to some sort of power-driven brush with steel wire bristles. Plates can be cleaned quickly with a pair of brushes somewhat wider than the width of the largest plate, mounted horizontally and rotating in opposite directions. The plates are cleaned by passing them between the brushes. Square and rectangular shapes are often brushed on a similar type of machine, but in which the brushes are mounted vertically and the carbon passed through twice, or through two successive machines, being given a quarter turn in the plane of its cross-section between the first and second brushings so that all sides may be cleaned. Round electrodes are often cleaned on the periphery of horizontal or vertical wheels, and in some cases by steel brushes mounted on the inside of revolving rings.

Carbons which cannot be completely cleaned on the brushes are finished on the stoning wheels. These are large wide-faced wheels of emery or other similar abrasive material. Small round electrodes whose length does not exceed more than six times their diameter can be very successfully and readily cleaned by tumbling in steel tumbling barrels loaded about seven-eighths full. Cast-iron, star-shaped jacks (about ¾ to 1 in. size) are used to assist in the cleansing operation. The tumblers are horizontal steel cylinders with removable covers, for loading and unloading, mounted on hollow shafts connected to each end. One end is open to the air through the hollow shaft, and the other is connected to piping leading to the exhauster of a dust-collecting system which discharges into some sort of collector, often of the cyclone type. Electrodes which have not been sufficiently cleaned by tumbling go to the brushes and stones for final cleaning.

Cleaning practice in the various electrode plants differs materially even when the same type and size of product are being handled. In the case of small electrodes it was formerly the practice to brush all electrodes, and tumbling barrels were used to clean only those which were too dirty for the brushes. In some modern plants, as a result of scientific management, this procedure has now been completely reversed and considerable saving effected. All electrodes are tumbled for a short while and only those still unclean after this procedure are brushed and stoned. Records of this method with small round electrodes show that all but a small percentage are cleaned without brushing.

It is general practice to equip all cleaning apparatus with suction hoods, connected to a dust collector. This is done with the view of supplying better working conditions, and also to recover as much as possible of the packing material removed from the carbons.

Mention has been made in a previous article[2] of the

*For Parts I to V, see *Chem. & Met. Eng.*, vol. 27, Nos. 3, 4, 5, 6 and 7, pp. 109, 161, 205, 258 and 312.

[2]See Part V, *Chem. & Met. Eng.*, vol. 27, No. 7, p. 312, Aug. 16, 1922.

resistivity of the carbon electrode. Its discussion, however, has been delayed to this point, since its determination is usually made in the plant testing laboratory, which is generally located in or near the cleaning and shipping departments. In general two methods of testing are used:

1. Measurement is made of the voltage drop, with a given current, through a known distance of an electrode having a uniform cross-section. Direct current is passed through the whole electrode. Resistivity or specific electrical resistance is then obtained by the use of Ohm's law and the formula for specific, calculated from total resistance. The formula[34] $\rho = SE \div lI$ gives a result in ohms per inch cube when S and l are expressed in square and linear inches respectively, or per centimeter cube when S and l are expressed in square and linear centimeters.

For ordinary purposes it is sufficient to measure resistance to 0.0001 ohm, a precision of about 5 per cent. By this method the voltmeter will show a voltage drop due to resistance through the whole potential circuit—that is, it will include voltage drop due to resistance of the potential contacts and the lead wires. The resistance of the potential contacts may be practically eliminated by drilling small mercury cups in the carbon or pressing the contact pins against the carbon at a pressure of about 3,000 lb. to the square inch when using a millivoltmeter having a resistance of 1.07 ohms.

2. Measurement is made directly of the resistance of an electrode or a portion of an electrode by comparing it with a standardized resistance by means of a resistance bridge. This method is more accurate than the first, because it is a zero method and comparison is made directly with a standardized resistance the accuracy of which can be made very high. The instrument generally used is the Leeds & Northrup Kelvin double bridge ohmmeter.

Resistivity is calculated from the formula $\rho = (S \div l)R$, where ρ = resistivity, l = length, S = cross-section, R = scale reading of resistance.

Where measurement is made of the circumference in the case of round electrodes, this formula becomes $\rho = \text{cir } R \div 12.57\, l$.

[34] ρ = specific resistance, S = cross-section, E = voltage drop, I = current in amperes and l = length or distance.

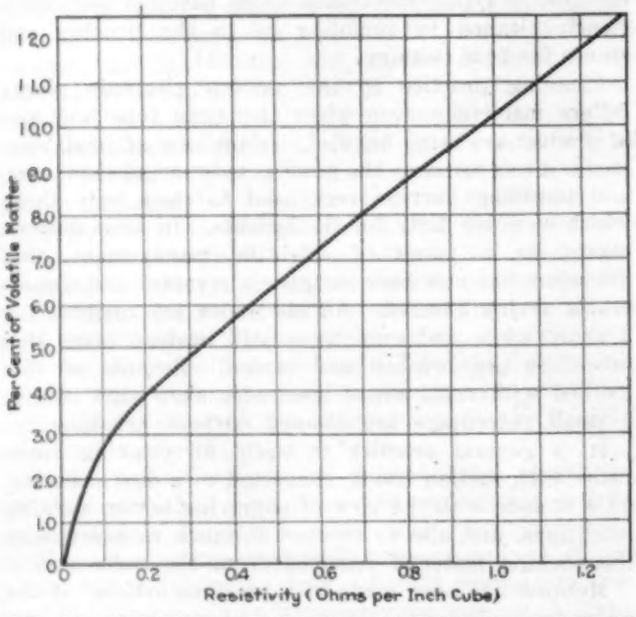


FIG. 36—RESISTIVITY-VOLATILE MATTER RELATION OF CARBON ELECTRODES

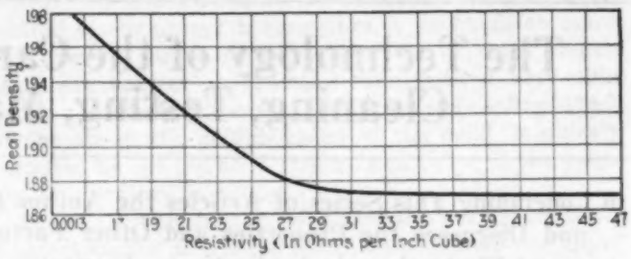


FIG. 37—RESISTIVITY-REAL DENSITY CURVE FOR CARBON ELECTRODES

In plants where large numbers of the same sized electrodes are being made and tested, it is usual practice to provide permanent potential and current contacts. Potential contacts are often V-shaped, made of copper, brass or steel, with knife edges on the inside of the V. While making the measurement, the electrode is supported in a horizontal position by the knife edges. The pressure of the weight of the electrode against the knife edges of the V is sufficient to afford good contact. Current contacts are often copper, brass or steel plates in which there are imbedded short cylindrical rods, pointed at the ends. The points of the rods are pressed against and into the ends of the electrode by pressure exerted against the plates in which the rods are imbedded.

Factors Affecting Resistivity

The electrical resistivity of carbon electrodes varies inversely as the elemental carbon content, directly with the ash content, directly with the percentage of volatile matter and inversely as the apparent and real densities. As the percentage of elemental carbon increases, the percentage of ash and volatile matter will decrease and the resistivity will decrease. As the percentage of ash increases, there will be more and more of materials whose known resistances are greater than that of carbon, and the resistivity of the material as a whole will increase.

The curve in Fig. 36 shows the resistivity-volatile matter relation of carbon electrodes. The relation between real density of electrodes to resistivity is shown in Fig. 37.

Resistivity increases with decreases in apparent density; and as a result, increases with increases of porosity. As the percentage of graphite in electrodes increases, the resistivity will decrease, since graphite has a resistivity of about one-fourth that of amorphous carbon. The real density of an electrode is the density of the material of which it is composed, free from pores or voids. It may be considered as a measure of the chemical composition of the material and increases as the amount of hydrogen in the hydrocarbons in the electrode decreases. It is thus an indication of the relative rate of oxidation of the electrode, it being a general rule that hydrocarbons high in hydrogen are most readily oxidized.

The apparent density—that is, the density of the carbon including the pores or voids—may be considered as a characteristic of the mechanical structure. It is influenced by every process through which the carbon goes in the manufacture of the electrode and is in general a measure of the relative rate of disintegration of the electrode in use. For large electrodes the most

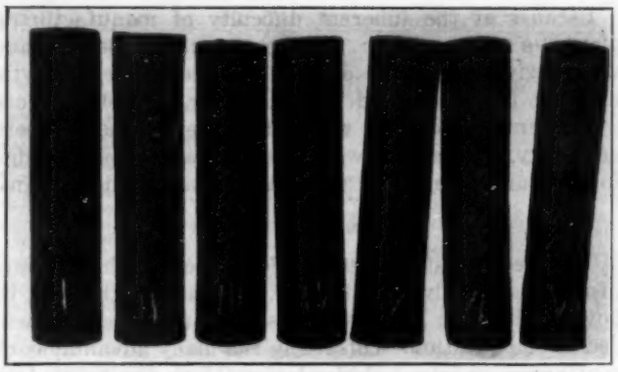


FIG. 38—ROUGH-SKINNED ELECTRODES
(No. 1 is smooth-skinned for comparison)

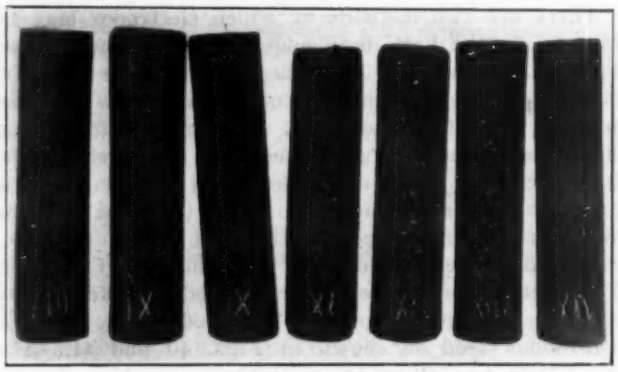


FIG. 39—OTHER EXAMPLES OF DEFECTIVELY BAKED ELECTRODES

satisfactory method is to weigh the whole electrode and calculate its volume from its dimensions. Where W equals weight and V volume, then

$$\frac{W \text{ (in lb.)}}{V \text{ (in cu.in.)}} = A.D. \text{ (apparent density) in lb. per cu.in.}$$

or more commonly

$$\frac{W \text{ (in grams)}}{V \text{ (in c.c.)}} = A.D. \text{ in grams per c.c.}$$

To obtain a precision of 2 per cent, the weight and length should be measured to 1 per cent and the diameter or periphery to 0.5 per cent.

Physical Inspection

The cleaned carbons are inspected for cracks, flaws, shape, surface roughness and uniform hardness throughout the length of the electrode. Cross checks, splits and die rings, discussed previously in reference to the green carbon,[25] may have been developed during the baking process either as a result of defects which slipped by the green inspection or originated in the baking furnace. Misshapen electrodes go into the scrap pile. Occasionally the furnaces may produce electrodes which are perfect except for an end which is so soft that it can be cut off with a knife or easily knocked off. Such carbons are rejected. Unusually rough-surfaced carbons, resulting from a blistered or rough condition in the green or from adhering packing material which has become a portion of the electrode and cannot be removed, are thrown out. All scrap resulting from the inspection of cleaned electrodes is returned to the manufacturing process by being used as calcined material in the grinding and pulverizing mills. Figs. 38 and 39 show some finished small round electrodes with rough surfaces.

It is at this point, along with physical inspection, that electrodes are rejected for resistivity above the standard and apparent density below the standard. Carbons of high resistivity are termed "re-bakes" and are returned to the furnaces to be again submitted to the baking process. Electrodes very much below the standard for apparent density because of excessive porosity are thrown into the scrap pile, to go back into process as unground calcined material.

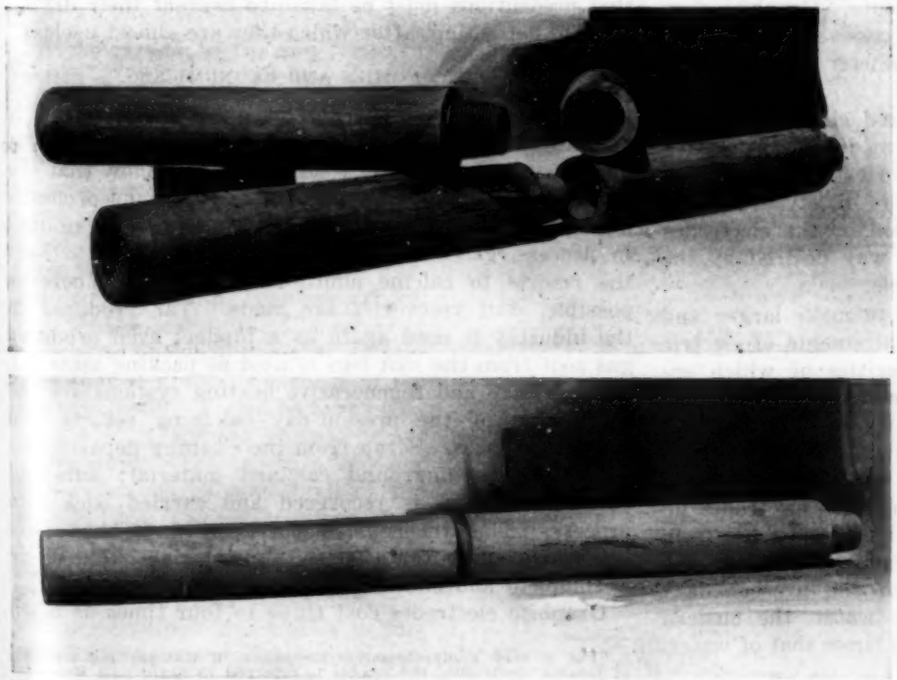
Machining Electrodes

Cleaned carbons, after passing inspection, are sent directly to the shipping room if they are to be used in their present form. If they are to be threaded or tapped, they are sent to the threading or machining departments.

Good amorphous electrodes are comparatively hard and more or less difficult to machine. High-grade machine-steel working tools are required and the threads are cut, holes drilled and tapped in the same manner that a piece of metal might be worked. Amorphous electrodes have a marked abrasive effect on the tools used in machining them—a fact which necessitates frequent regrinding and replacement. It is the opinion of the author, however, that the comparative difficulty of machining amorphous electrodes has been somewhat overstressed and made to seem more difficult than it really is.

Fig. 43 shows the threading and inspection departments of the Niagara Works of the National Carbon Co.

[25] See Part V, *Chem. & Met. Eng.*, vol. 27, No. 7, p. 312.



FIGS. 40 AND 41—GRAPHITE ELECTRODES THREADED FOR CONTINUOUS FEED

There are two methods by which electrodes may be joined. In the first, both ends are drilled and tapped so that a small threaded plug of electrode material may be screwed in the end of one electrode and the adjacent end of the next one. This method of joining electrodes is now largely used[26] for large electrodes. In the case of small electrodes, it is replaced by one in which one end of the electrode is threaded, and the other drilled and tapped so that the end of one electrode can be screwed directly into the end of another. This method will be better understood by referring to the illustrations of graphite electrodes threaded for continuous feed as shown in Figs. 40 and 41. The last illustration shows the method of assembly.

Shipping

After machining, the electrodes are inspected, those at fault returned to be re-machined if the fault can be corrected, or if not, are sent to the scrap pile to be used in the process as unground calcined material. The next step in process is shipping the finished product.

When a through shipment can be made, electrodes in carload lots are carefully packed and braced in the car without being boxed. In less than carload lots, it is usual practice to employ wooden boxes, the sizes of which vary according to the size of the electrodes. Sawdust is used to hold the carbons in place and prevent breakage. The Acheson Graphite Co. uses a case having a gross weight of 350 to 360 lb., containing a net electrode weight of approximately 300 lb. In the case of amorphous carbons, case sizes and weights will vary with electrode sizes.

Trade Usages

The requirements of the trade for both graphite and amorphous carbon electrodes vary between very wide limits. For this reason, the different electrode companies make no attempt to carry in stock all of the various sizes and shapes.

Carbon electrodes are manufactured in any size and shape desired. For ordinary use, the cylindrical or square shapes satisfy all requirements. Graphite electrodes may be obtained with any cross-section between the limits of ¼ in. to 12 in. in diameter and with any length up to 60 in.

The ease of machining graphitized electrodes is too well known to require any extensive discussion. They are easier to machine than the softest iron and may be finished with the same degree of nicety. Threads can be cut, holes drilled and tapped or the electrodes surfaced, sawed or shaped in any way desired by the use of ordinary wood-working tools.

The tendency in the industry is to make larger and larger electrodes to satisfy the requirements of electric furnaces, the dimensions and capacities of which are ever increasing. The largest single electrode which the industry has produced was made recently by the National Carbon Co. It is 24 in. in diameter, 180 in. long and weighs approximately 4,500 lb. If the demand existed this company is equipped to make electrodes up to 36 in. in diameter. Certainly, it is a long cry from Bunsen's first little sticks of carbonized wood to the mammoth high-density electrode of the present day! Bunsen's electrodes would float on water, the modern electrode has a density more than 1½ times that of water.

[26] See page 27 of "The Carbon Electrode," published by the National Carbon Co., Inc., New York, 1922.

Because of the inherent difficulty of manufacturing plates of great width by the extrusion method and the relative inferiority of molded plates for electrolytic work, it is often found much cheaper, as well as more convenient, to obtain wide electrode surfaces where necessary, by placing two or more graphite plates edge to edge and connecting them with graphite dowel pins.

Joining Electrodes

The desirability of using joined electrodes in any process is mainly a matter of calculation; the cost of power, the cost of electrodes and their length will decide the question. Offsetting the many advantages of continuous or joined electrodes are these disadvantages: (1) Machining operations (drilling, threading and tapping) increase the cost of the electrode. (2) The contact resistance between the portions of a built-up electrode causes loss of energy. (3) The joint is apt to loosen and to increase these energy losses, or the end of the electrode in the furnace may drop off, causing short circuits or other troubles.

On the other hand, the joint in a built-up electrode length serves as a very good thermal valve and lowers the thermal conductivity of the electrode, lessening the amount of heat conducted out through the electrode from the furnace.

In cases in which the furnace and the electrode holder permit the use of the electrode down to a small butt, in many cases it will be found more advisable not to join the electrode.

A good electrode paste is always used in practice to cut down the joint resistance losses. Experiment has shown that this joint resistance decreases as the electrode heats up and the paste dries or bakes. With the well-made electrodes the joint resistance, expressed in equivalent electrode length resistance, is very small.

The electrode manufacturers put up electrode pastes ready for use. They are usually thick suspensions of pulverized carbon or graphite in some medium that will be quickly volatilized by the heat at which the electrode is used. The chief difficulty with pastes is that precautions must be taken to prevent their drying out and hardening, after which they are almost useless.[27]

Economies and Economics

The complete flow sheet of electrode manufacture is introduced at this point to complete the discussion of processes. (See Fig. 42.) A glance will show that the industry loses practically nothing as waste and produces no byproducts. Green electrode scrap is re-used in process, gases from calcination are burned to heat the retorts to calcine additional material. Wherever possible, dust recoveries are made. Tar produced in the industry is used again as a binder; even producer gas soot from the soot legs is used as packing material. Recuperative and regenerative heating systems are the foundation of the present-day calcining retorts and baking furnaces. Scrap from the cleaning departments is re-used as unground calcined material; adhering packing material is recovered and carried back into process. The unconsumed portions of finished electrodes are sometimes used as raw materials. The circle is complete and endless.

Graphite electrodes cost three to four times as much

[27] For a very comprehensive discussion of the various methods of joining electrodes, the reader is referred to *Stahl und Eisen* for March 20 and April 3, 1913, translated into English in *Chem. & Met. Eng.*, June, 1913, p. 321.

TABLE I—COMPARISON OF AMORPHOUS AND GRAPHITIC CARBON ELECTRODES

	Acheson Graphite Electrodes	Amorphous Carbon Electrode*	Gas-baked Amorphous Carbon Electrode†	Large Electrothermal Electrodes	Copper	Aluminum	Iron
Specific resistance (ohms per inch cube)	0.00032	0.00124	0.00161	0.00220	0.00000065	0.00000120	0.00000380
Specific resistance (ohms per cm. cube)	0.000813	0.00325	0.00400	0.00550	.....	.....	.....
Comparative section area for same voltage drop	1	3.8	4.4	6.8	.....	.....	.....
Weight, lb. per cu.in.	0.0574	0.0564	0.0560	0.058	0.320	0.090	0.280
Weight, lb. per cu.ft.	99.0	97.5	97.0	100.0	554	155	484
Apparent density, grams per c.c.	1.585	1.558	1.55	1.60	.....	.....	.....
Tensile strength, lb. per sq.in.							
Lengthwise	800–1,000	1,000–1,500	1,000–1,500	.....	20,000–30,000	24,000–30,000	30,000–50,000
Crosswise	500– 600	600– 900	600– 900	.....	.....	.....	.....
Temperature of oxidation in air, deg. C.	640	500	500	500	.....	.....	.....

*Very good electric baked electrode (small). †Typical small electrode.

per pound or per piece as corresponding amorphous carbons. This might be explained by the fact that electrodes to be graphitized cannot be baked in gas-fired furnaces, which, it will be recalled, has been shown to be far cheaper than the electric method. In the second place, in order to graphitize a carbon article, several times as much power is used as would be needed to convert it into a good grade of amorphous carbon. By far the largest cost item in graphite electrode manufacture is the baking to graphitization.

The cost of any particular size of electrode to the trade will depend upon several factors: (1) The difficulty of forming that particular shape in the green. (2) The percentage of scrap normally resulting and necessary to reprocess. (3) The difficulty or ease of loading, baking and cleaning the particular shape and size. (4) The percentage of breakage, replacement and excess necessary to complete the order. In the case of both graphite and amorphous carbons the percentage of breakage during and after baking is a serious item.

Comparison of Amorphous and Graphitic Carbons

A comparison of the two forms of carbon of which electrodes are made, amorphous and graphitic, is given in Table I. Good graphitic electrodes have about one-fourth the resistance of good amorphous electrodes of the same size. The apparent density of graphite electrodes is usually two or three points higher than that of fine-grained petroleum coke electrodes. The tensile strength of amorphous carbons is about 50 per cent greater than that of graphitic carbons of the same diameter. It will be found that ordinarily graphite electrodes are much purer—that is, have a lower ash—inasmuch as almost all of the metallic and metalloid oxides were volatilized by the temperatures reached during the baking to graphitization. Copper, aluminum and iron are included in the table to permit of a comparison with carbon electric conductors. The comparative size of graphitic and amorphous carbon electrodes of equal ohmic resistance is shown in Fig. 45. Graphite and amorphous carbon electrodes are not competitors. The properties of each particularly fit it for distinctly different fields. The field of the amorphous carbon, used in large quantities, is that of electrothermal work, where the fact that its cost is only one-third to one-four'h that of graphite off-

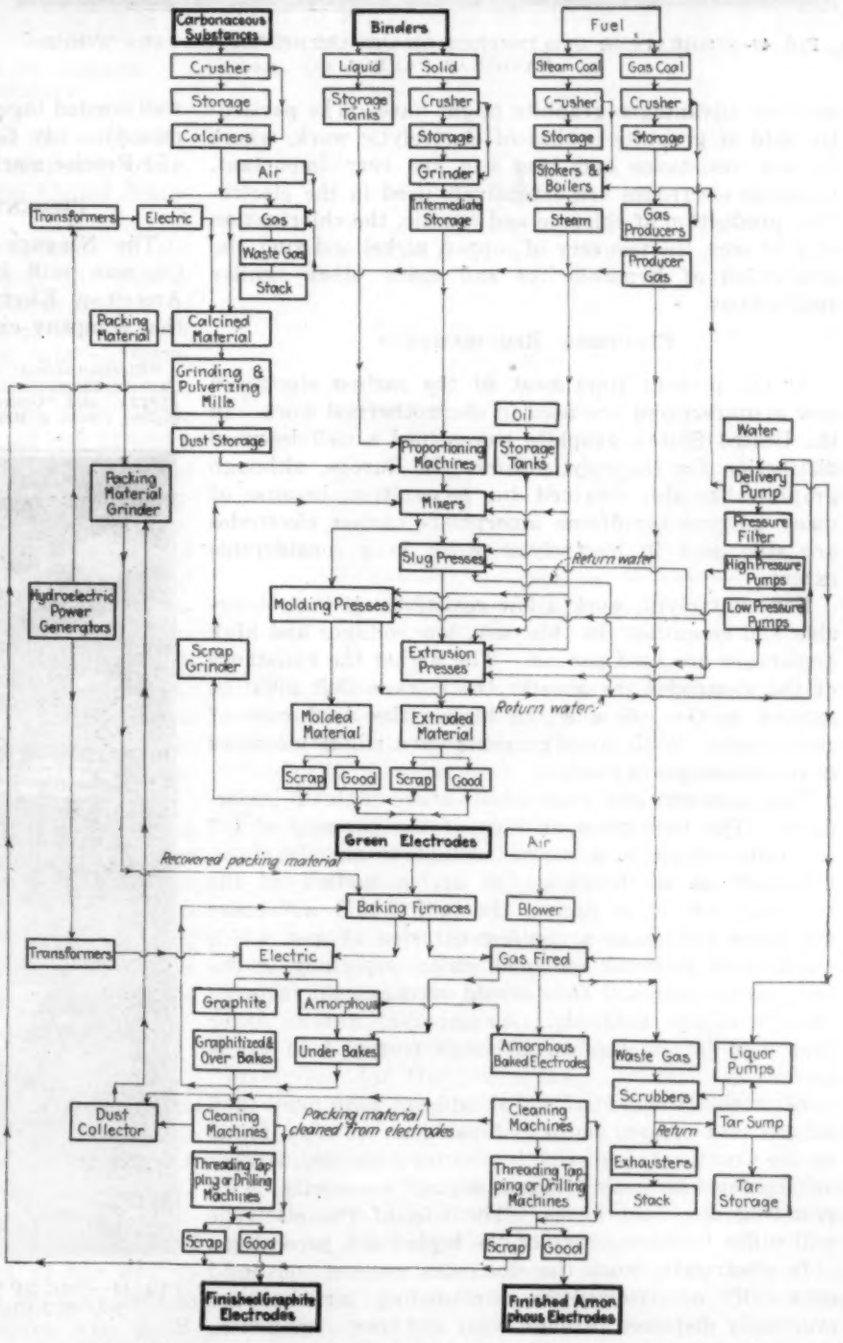


FIG. 42—FLOW SHEET OF CARBON ELECTRODE MANUFACTURE

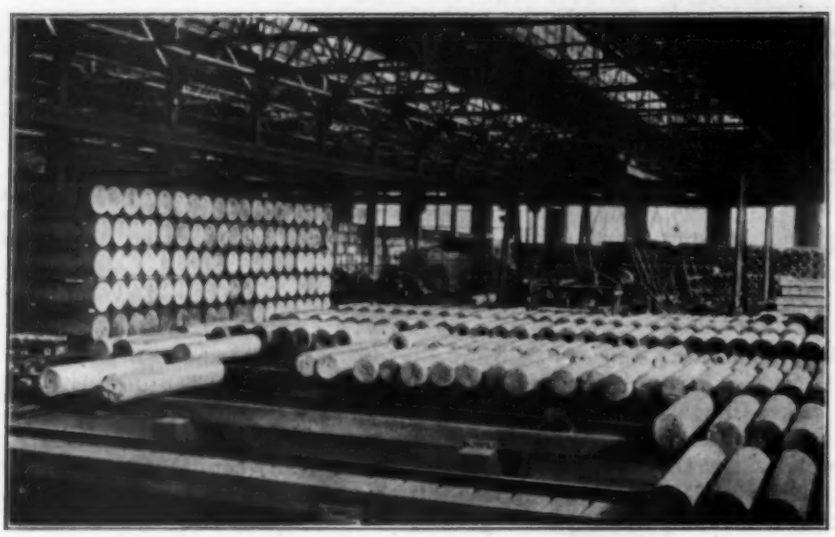


FIG. 43—THREADING AND INSPECTION DEPARTMENTS, NIAGARA WORKS, NATIONAL CARBON CO.

sets any advantages graphite might have. The particular field of graphite is that of electrolytic work, where its low resistance and long life are very important. Graphite electrodes are extensively used in the electrolytic production of chlorine and caustic, the chlorination of gold ores, the recovery of copper, nickel and zinc, the production of hypochlorites and many other similar applications.

Electrode Requirements

At the present time most of the carbon electrodes now manufactured are used in electrothermal work. In the United States, graphite has gained a well-deserved distinction for electrolytic work. In Europe, although graphite has also obtained due recognition, because of many adverse conditions amorphous carbon electrodes are still used in electrolytic work to a considerable extent.

For electrolytic work a low resistivity is both desirable and essential. In this case, low voltages and high amperages are used per cell. The higher the resistance of the electrodes the greater the voltage that must be applied to the cell and the higher the dead cost of electrolysis. With large currents even slight increases in resistance prove costly.

The apparent and real densities are both of importance. The first gives an idea of the porosity of the electrode, which to a certain extent is an advantage, inasmuch as it increases the active surface of the electrode, but if in excess, the bath liquid will enter the pores and cause a rapid generation of gas, which would tend to break off small chips, especially at the less porous edges. This would mechanically shorten the life of the electrode. An apparent density lower than 1.54 is undesirable, although from 1.4 to 1.6 is used.

Electrodes for electrolysis should not have more than 2.5 per cent of ash, and 4 to 5 per cent, as often found on the Continent, is distinctly disadvantageous. Higher ash content invariably means higher resistivity, with resulting electrical losses. The life of the electrode will suffer in consequence of the higher ash percentage.

In electrolytic work the electrodes are not consumed chemically or oxidized by surrounding air, but are eventually displaced through wear and tear. Impurities in the electrode do not therefore get into the cells in any great quantity through consumption of the electrode. In electrothermal work, however, the electrode is consumed largely by oxidation. The higher the apparent density the greater will be the amount of material packed in a given volume and the greater will be the length of time necessary to consume that volume. A carbon with a low apparent density offers a greater surface for oxidation per unit of weight than one with a high apparent density.

In summing up the requirements, it may be said that the following properties are necessary for the satisfactory performance of an electrothermal electrode:[27] (1) High electrical conductivity (low resistance). (2) Slow rate of oxidation (high apparent density). (3) Great mechanical strengths (particles well bonded together, suitable aggregate and thoroughly mixed). (4) Good shape and accuracy of dimensions. (5) Precise machining. (6) Low-heat conductivity.

Present and Future Developments

The Niagara Falls works of the National Carbon Co. was built in 1911. At the 1914 meeting of the American Electrochemical Society at Niagara Falls, that company exhibited a carbon 20 in. in diameter, 84

[27]Electrothermal electrode specifications may be found in "The Carbon Electrode," p. 34, published by the National Carbon Co. (1922), and "Operating Details of Electric Furnaces," by E. T. Moore, *Chem. & Met. Eng.*, vol. 24, No. 4, pp. 171-6, Jan. 26, 1921.

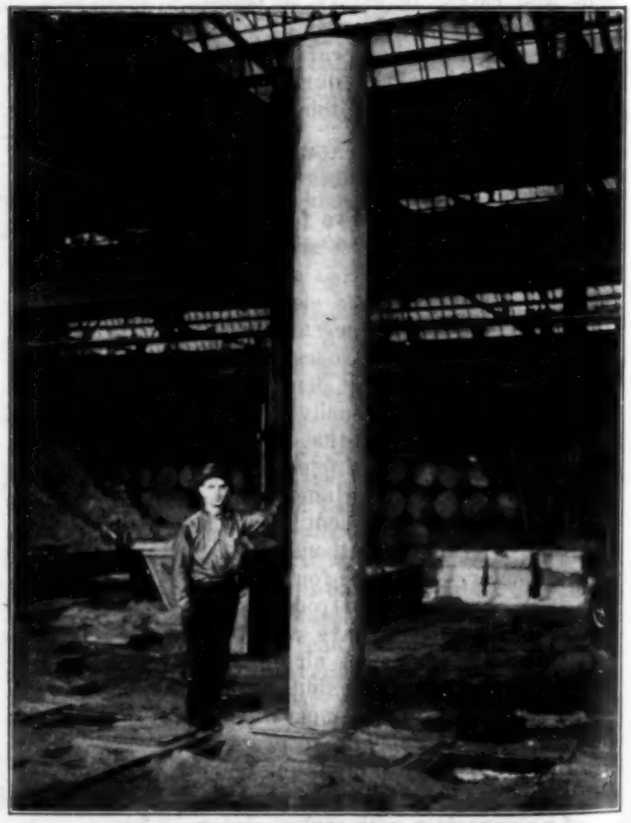


FIG. 44—ONE OF THE LARGEST ELECTRODES EVER MANUFACTURED. LENGTH 180 IN., DIAMETER 20 IN. WEIGHT 3,180 LB.

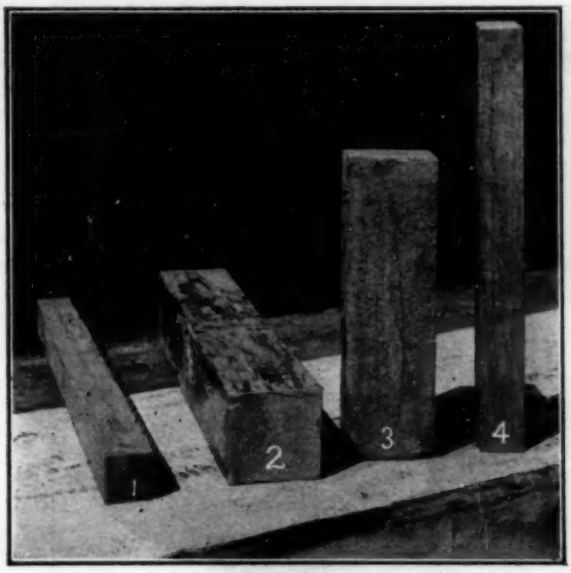


FIG. 45—GRAPHITIC AND AMORPHOUS CARBON ELECTRODES OF EQUAL RESISTANCE

in. long and weighing 1,450 lb. In 1921 the same company produced electrodes of larger diameter and 180 in. long. Such has been the progress in the United States inside of less than 10 years.

While there have been many developments in the electrode industry in the past 10 years, the coming decade should bring forth even greater progress. It is possible here only to hint at some of the lines of development along which this progress will be made. Pitch coke is being developed as a raw material as a result of the possible shortage of petroleum coke. Probably there will be developed a tar or pitch still in which it will be possible to produce coke of such a fineness and of such a low content of volatile matter that the operations of calcining and pulverization will be unnecessary.

Developments along the line of the newer ring-type of gas furnaces have made possible the reduction of the cost of the baking process. The hydrocarbon gases generated from the binder in baking are used as fuel for heating sections of the furnace, thus making a considerable saving in producer gas. There have been some minor small developments along the lines of continuous electric furnaces (which is the superior but costlier baking method), with a view to recovering some of the enormous heat losses of radiation and cooling.

And last, but not of least importance, is the growing tendency for technical men in the industry to exchange information regarding the fundamental principles underlying the technology of carbon-electrode manufacture. Eventually this will result in greatly benefiting the industry as a whole and making it less and less of the "black art" which has characterized it in the past.

ACKNOWLEDGMENT

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For their kindly and helpful criticism of these articles, the author desires to thank F. J. Vosburgh and A. T. Hinckley of the National Carbon Co.

French Specifications for Impact Test

No particular type of testing machine or test-bar is specified by the French Committee on Standardization, but brief instructions concerning proper methods of testing are given below:

"The bar shall rest on bearers, 40 mm. apart, and shall be accurately placed before the blow is applied. The bearers shall have their upper surfaces rounded to a radius of 1 mm. A clearance in accordance with that shown in Fig. 1 shall be allowed in order to reduce friction at the extremities and to avoid the wedging of the bar.

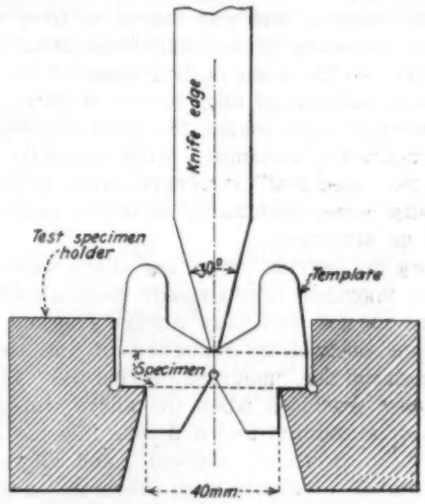

FIG. 1—TEMPLATE FOR LOCATING IMPACT TEST-PIECE

"The knife-edge fixed to the falling weight shall have a triangular section, the angle at the apex not being greater than 30 deg. The striking edge shall be rounded to a radius of 1 mm. It is absolutely necessary that the distance between the bearers shall be very frequently verified with a special template, and it is also necessary to insure that the knife-edge fixed to the falling weight is exactly in the middle of this distance.

"The position of the test specimen on the bearers must also be very carefully verified for each test with a special template, the position of the notch being taken into account. The speed of the blow shall not be less than 5 m. per second. Unless any figure is specially prescribed for the temperature, it shall lie between 15 deg. and 20 deg. C. The influence of the temperature is much more marked than in any other method of testing."

Two styles of test-bars are in use, the Mesnager and the Charpy. The former is 10x10x55 mm., notched 2 mm. by 2 mm. and round at the bottom; the Charpy bar is the same size, notched 5 mm. deep by a cylindrical hole 1.3 mm. in diameter and opened by a saw cut 1 mm. wide.

"Modification" of Aluminum-Silicon Alloys

By James J. Curran
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RECENT publication of articles on the alloys of aluminum and silicon has stimulated considerable interest in this subject. Three articles published within the last few months describe at some length the alloys containing from 5 to 15 per cent of silicon, and all call attention to the fact that alloys of this group may possess either one of two entirely dissimilar structures, spoken of as "normal" and "modified" or "refined." Some of the conditions under which either type of structure occur or may be obtained are stated by the various writers, who also remark on the superior tensile strength and elongation observed in alloys possessing the "modified structure. No reasonable explanation for the difference in structure and physical properties is suggested.

Previous to the appearance of these articles, the writer had occasion to examine a casting of "normal" alloy containing about 11 per cent silicon. This was a hydraulic casting and was stated to have withstood a hydraulic pressure of approximately 200 lb. without leaking, whereas the same casting made of the ordinary No. 12 aluminum-copper alloy leaked at 40 lb. pressure. This impervious state makes the alloy extremely desirable for hydraulic castings. More recently a sample showing the "modified" structure came to our attention, causing some speculation as to the reason for the difference in structure.

According to Jeffries[1], when the alloys were prepared by melting together commercially pure aluminum and silicon, the normal structure always resulted, whereas simultaneous electrolytic reduction of the two metals always produced the "modified" structure. This structure was also produced when the alloys were prepared by fusion of aluminum and a double fluoride of silicon and potassium (Wöhler's method), and alloys exhibiting the "normal" structure were converted to the "modified" form by fluxing with fluorides of the alkali metals.

[1] "Aluminum-Silicon Alloys," *Chem. & Met.*, April 19, 1922.

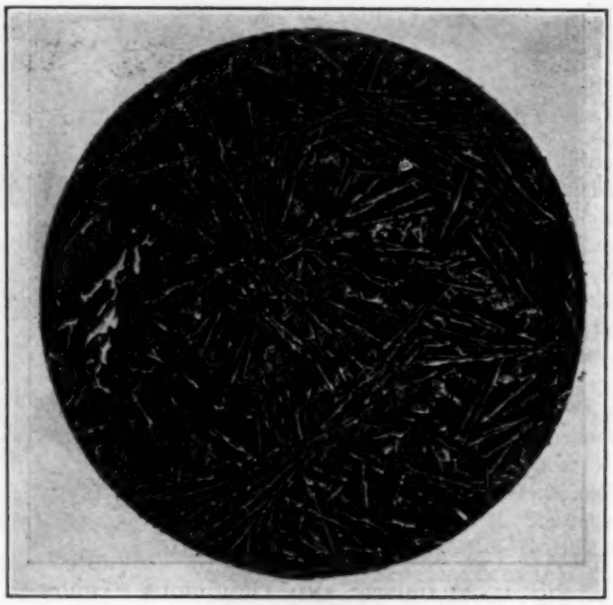


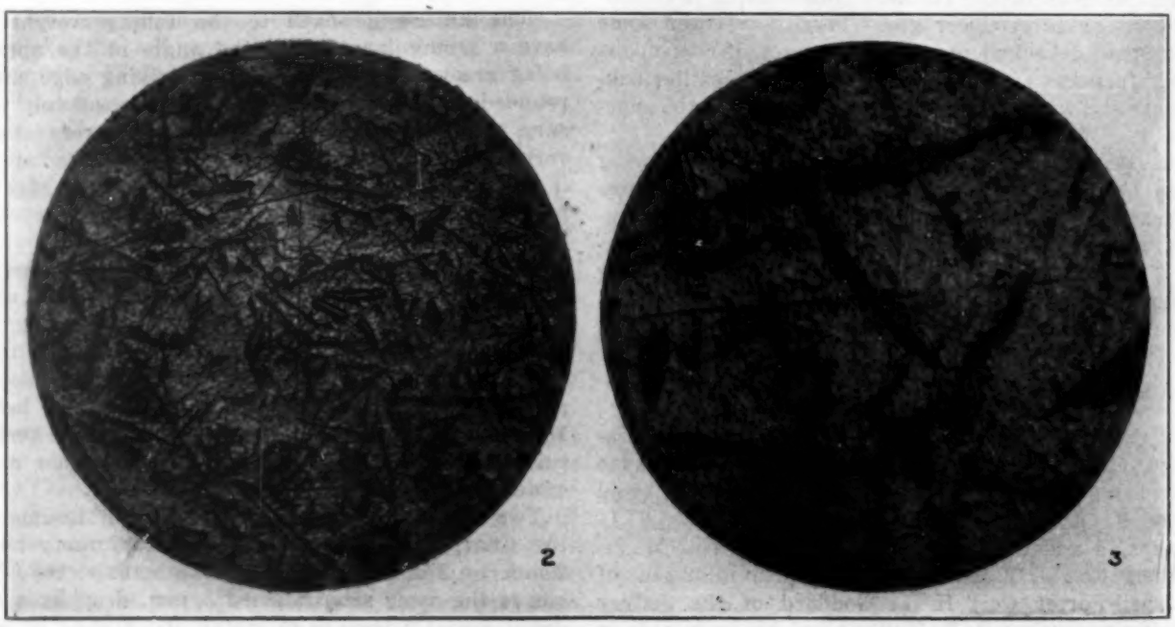
FIG. 1—STRUCTURE OF CASTING AS RECEIVED. "NORMAL." × 100. ETCHED WITH NaOH SOLUTION

All of these alloys, however, reverted to the "normal" form on remelting and holding in the molten condition for some time.

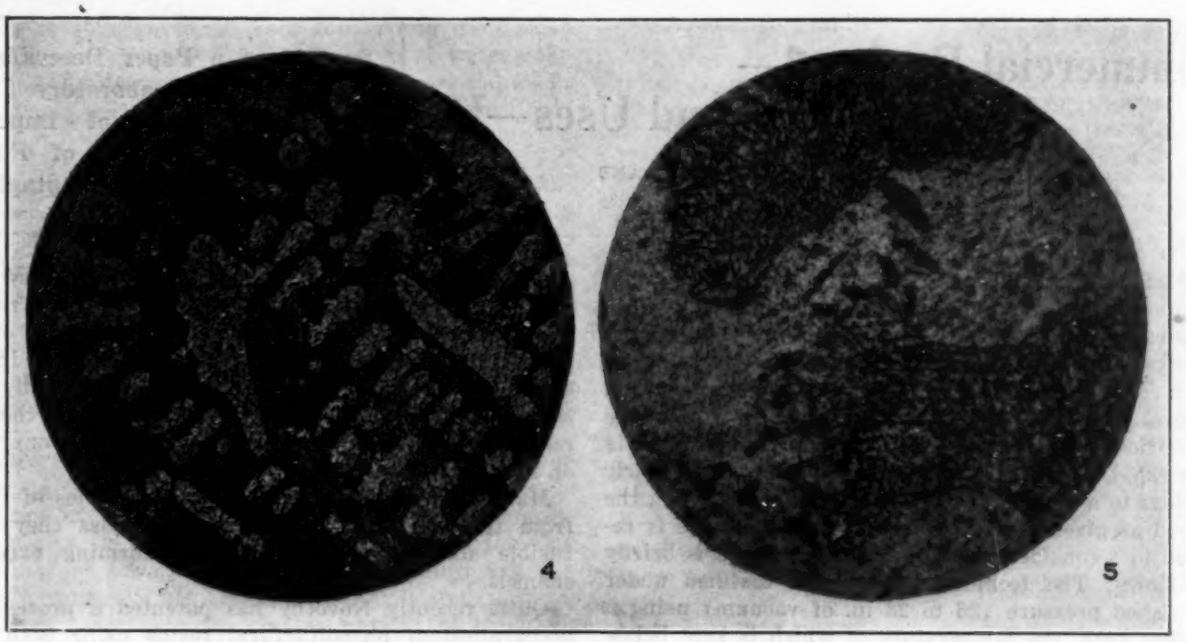
According to Guillet[2] and R. E. Search[3], the change in structure produced by the action of alkali fluorides on the melted alloys was ascribed to the removal of oxides, etc., or, in other words, simple fluxing.

The radical change in structure produced seemed to the writer to have a much deeper meaning than that ascribed, however. Examination of the historical data given in Jeffries' article indicates that the "modified" structure results only when alkali fluorides enter into the preparation of the alloy. For instance, the reaction between an aluminum-silicon alloy and NaF may form a small amount of Na and SiF_4. The SiF_4 formed is immedi-

[2] "Les Alliages Aluminium-Silicium et leurs emplois industriels," *Revue de Métallurgie*, May, 1922.
[3] "New Aluminum-Silicon Alloys," *Metal Industry*, May, 1922.



FIGS. 2 AND 3—STRUCTURE OF INGOT AFTER REMELTING. "NORMAL." × 100 AND × 500 RESPECTIVELY. ETCHED WITH NaOH SOLUTION



FIGS. 4 AND 5—STRUCTURE OF INGOT AFTER REMELTING AND ADDING SODIUM. "MODIFIED." × 100 AND × 500. RESPECTIVELY. ETCHED WITH NaOH SOLUTION

ately removed from the sphere of action, due to its gaseous state. The reaction takes place in a bath of aluminum which may be regarded as either a neutral or reducing medium or atmosphere, with the result that the Na produced cannot react to form any compound or salt, but is immediately dissolved in the aluminum.

It seems probable that alkali chlorides would give a similar reaction with evolution of $SiCl_4$, although it is possible that higher temperatures would be necessary. Other salts of the alkali and alkaline earth metals might also be selected to give similar effects under similar conditions.

If the alloy is prepared by simultaneous electrolytic reduction, we would expect a small amount of the alkali metal to be produced. This has been reported as a serious drawback to several of the early electrolytic methods of producing aluminum. Kahlenberg and Trautman (*Trans.*, Am. Electrochem. Soc., vol. 39) were apparently unable to produce the alkali and alkaline earth metals or silicides by reduction of their salts by silicon, although they quote Askenasy and Pounay as producing barium silicide by this means. Their failure was undoubtedly due to the fact that these metals, and probably also the silicides, oxidize rapidly in air. If the reduction were carried on in a neutral or reducing atmosphere, such as is afforded by a bath of aluminum, the results would have been different.

Remelting of a "modified" alloy—assuming it contained a small amount of alkali metals—would undoubtedly result in the elimination of the latter, thus explaining the reversion to "normal" structure noted by the writers quoted.

Having thus established a case for the alkali metals, the writer attempted to synthesize the "modified" alloy without the use of fluorides, as follows:

A casting possessing the "normal" structure shown in Fig. 1 and having the composition aluminum 88.32 per cent, silicon 10.72, iron 0.70, copper 0.16, manganese 0.01, carbon 0.09, was cut into small pieces, some of which were melted in a small crucible at a temperature of about 1,350 deg. F. The crucible was then removed from the furnace and the melt permitted to solidify in the crucible. The resulting alloy was then examined microscopically. The structure observed is shown in Figs. 2 and 3 at magnifications of 100 and 500 diameters respectively. This structure is characteristic for the "normal" alloy.

The remainder of the original casting was then melted as before in a small crucible at about 1,350 deg. F. and a small piece of metallic sodium was stirred into the metal, then the crucible was removed from the furnace and the melt permitted to solidify. Microscopic examination disclosed a characteristic "modified" structure—shown in Figs. 4 and 5.

Since the only difference in the preparation of the two melts was in the addition of sodium to the second melt, we believe that this is conclusive proof that the "modification" is caused by the absorption of sodium to form a ternary alloy. This would explain the failure of the "modified" alloys to behave according to the usually accepted binary aluminum-silicon diagram. No attempt was made to determine the amount of metallic sodium in the alloy, but its presence was indicated by an evolution of gas when the polished specimen was washed in water before etching.

In alloys for hydraulic purposes, resistance to corrosion is a very desirable property. The aluminum-silicon alloys are reported to be quite resistant to corrosion, and curves are given by Guillet in which one of the alloys is compared with others on the basis of resistance to corrosion. It is not stated definitely, however, whether the alloys were tested in the "normal" or "modified" condition. We would expect that the "normal" condition would show the greater resistance to corrosion and that the "modified" alloy, due to its content of alkali metal, would show inferior properties. The presence of small amounts of alkali metals caused rapid corrosion in aluminum produced in the early days of the electrolytic method, and one might expect similar results in the aluminum-silicon alloys, depending on the amount of alkali metal present. Comparison tests on the resistance to corrosion of the commercially prepared "normal" and "modified" aluminum-silicon alloys would therefore be instructive.

Commercial Furfural— Its Properties and Uses—II*

Part II of a Paper Describing the Rise of a Laboratory Curiosity to Industrial Importance — General Uses of Furfural — Complete Bibliography

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EARLY in the investigation of furfural, its property of discoloration was noted especially when exposed to light, the change taking place more rapidly in the anhydrous material than in the technical, which contains about 4½ per cent water. When technical furfural is distilled at atmospheric pressure to separate impurities, the color change in the purified product is quite rapid, changing in the course of a day from nearly colorless to a deep amber color. However, by using the method as given by R. Adams, this color change is retarded to a considerable extent. This method is briefly as follows: The technical furfural is distilled under diminished pressure (26 to 28 in. of vacuum) using a paraffine bath, the temperature of which is kept below 130 deg. C. At first water and furfural distill and separate in two layers. After about 15 per cent of the initial volume is collected the distillate coming over is pure furfural. The next 65 per cent is then collected as pure material. It should be stored in amber colored bottles.

Those who require a highly purified furfural for experimental work will obtain very satisfactory results by distilling technical furfural in accordance with the above directions just at or near the time it is desired for use.

Resins

Recently there has been an active interest taken in the manufacture of resins from furfural. Quite early in the history of furfural it was noted when working with the pure product or very concentrated solutions that instead of the desired reactions taking place, a tarry mass resulted. Stenhouse, in 1840, and Fownes, in 1845, in their earliest work on furfural, observed the formation of a brown resinous mass when furfural was boiled with alkali or acid. In 1887 L. Claisen attempted to prepare compounds from β-naphthol and furfural, using glacial acetic acid as the solvent and hydrochloric acid as the condensing agent. He obtained no well characterized compounds, obtaining only a brown resinous mass. No particular notice was taken of these products until the production of the phenol-formaldehyde resins became of commercial importance. Meunier (262) prepared a fusible, soluble resin by action of commercial aniline with an equal part of furfural in presence of alkalis. The product was a black resin, soluble in benzene and alcohol, giving a black enamel. Beckman and Dehn (261) made a rather extensive investigation of the condensation products of furfural with the phenols. They reported on the products obtained from 24 different phenolic compounds. They obtained their best results with phenol, raw cresol, guiacol, carvacrol and β-naphthol, using 5 per cent of hydrochloric acid as the condensing agent and equal parts furfural and the phenol.

Their work using basic catalyzers such as sodium carbonate, sodium hydroxide, etc., seemed to show that the reaction as well as the final product was not as desirable as the acid resins. In the experience of the authors this is at variance with the facts, as in our experience the alkali resins are much more easily controlled and the final product much superior to the acid resins. A paper is being prepared covering our work on these resins.

Mains and Phillips (258) prepared a series of resins from furfural with amines. In all cases they were fusible and soluble, the solutions forming excellent enamels.

Quite recently Novotny has patented a process for preparation of phenolfurfural resins using both furfural and furfuramide in its preparation. These are molding resins forming hard, infusible, insoluble products. We are informed that molding resins now are being successfully prepared on a commercial scale from furfural.

Varnish

Besides the preparation of the fusible, soluble resins which may be used as varnish resins, investigations have been made which seem to show the applicability of furfural either alone or in admixture with oil of turpentine in the preparation of varnishes. Claim is made of a much lower acidity than in the common methods of varnish manufacture.

Rubber

Some work has been done on the use of furfuramide in the rubber industry as a substitute for hexamethylenetetramine. The results of this work show some promise of its adaptability. It has been found to have decided accelerating effects. Further work is being done on this phase of its application.

Dyes

Practically all of the compounds reported on in the section of this paper devoted to the chemistry of furfural which are formed by the action of furfural on aromatic amines are either highly colored compounds or become so by oxidation. Many of these have decided staining or dyeing properties and in the light of recent investigations furfural gives promise of becoming of importance in the preparation of commercial dyestuffs.

Anesthetics

Dr. Gilman, at the Birmingham meeting of the American Chemical Society, reported on the preparation of an anesthetic from furfural. This opens up an entirely new field in the application of furfural.

Antiseptics and Germicides

Furfural has decided antiseptic and germicidal properties, as is brought out by the work of McGuigan. The authors of this paper studied the effect of furfural on the keeping qualities of bacteria infected glue. They found that glue that "went bad" in 18 to 24 hours after

*Part I of this article, describing the occurrence, manufacture and properties of furfural appeared in *Chem. & Met.*, vol. 27, No. 7, Aug. 16, 1922.

placing in solution would keep for several days when the solution was made in a 1:500 furfural:water solution, and that the solutions would keep for several weeks when made in a 1:250 furfural:water solution.

SOLVENT

The authors have under way an investigation of the solvent action of furfural. Among the interesting data developed to date are the facts: that furfural is an excellent solvent for both nitrocellulose and the hydrated cellulose acetates; that while linseed oil is very slightly soluble in furfural, chinawood oil is miscible in all proportions; that stearic acid is quite soluble in hot furfural, but is only soluble to about 1 part in 50 at 25 deg. C., while oleic acid is readily soluble at 25 deg. C.

Larger production and increased efficiency of manufacturing process will make possible the reduction in the price of furfural to a point where it can compete on a parity, or better, with formaldehyde and the high boiling point solvents. In view of the many possibilities of commercial utilization already indicated, it seems highly probable a vastly greater number of profitable methods for its use will be developed. Since it can be made from any of the pentosan-bearing roughages now either wasted or sold at extremely low price, it seems reasonable to predict that a considerable percentage of those millions of tons of what is now virtually waste material will ultimately form the basis of a new industry of enormous proportions.

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Magnetic Analysis of Metal

In any study of the physical properties of materials the effect of temperature is of great importance. It is well known that at a certain temperature ferromagnetic materials lose their ferromagnetic properties and become very feebly magnetic. It is not so well known, however, that certain more or less abrupt changes in magnetic properties take place at lower temperatures during heating and cooling and that these changes are often indicative of structural transformations in the material. The Bureau of Standards has designed and constructed apparatus for the purpose of investigating these phenomena. Little work of this nature has been done in this country, although valuable results have been obtained by this method abroad, especially by Japanese investigators.

Endurance Studies on Alloy Steel

Dr. H. W. Gillett, at the Ithaca station of the Bureau of Mines, has embarked upon an extensive program of endurance tests, using molybdenum and other alloy steels. About 600 test-pieces have been prepared, and two testing machines will be kept constantly in operation.

A New Tiering Truck

THE tiering truck equipped with electric motor and storage battery has a wide field of possible utility. It would have met with much greater favor from industry in general in the past, except that the models offered had certain defects of design which tended to curtail their usefulness. Many industries that could have effected real economy by using tiering trucks have held off making purchases of this type of equipment until one was offered which they considered dependable.

For this reason the "Eleveyor," a tiering truck recently placed on the market by the Electric Industrial Truck Co. of Brooklyn, N. Y., is considered noteworthy.

FIG. 1—ELEVEYOR WITH PLATFORM LOWERED

The makers of this truck claim to have eliminated numerous disadvantages found in some of the older models. One of the principal improvements claimed for the "Eleveyor" is in the design of the frame. This frame, as shown in the accompanying photographs, is made of structural steel throughout and is so designed as to increase greatly the strength and stability of the truck. Another advantage lies in the elimination of parts and in the unobstructed dash and operators step which results from this.

One of the chief features of the truck is the use of standard equipment, largely that developed in the automotive industry, wherever possible. The differential is a Brown-Lipe-Chapin. The main drive is through a Morse silent chain. All bearings are standard SKF deep grove ball bearings. The hoist is a triplex-geared chain hoist, operated by a G. E. motor. The driving motor is also a G. E. motor. The main controller is a G. E. heavy duty drum-type controller, so designed that the necessity of the "safety" switch found on most other designs of truck is eliminated, thus saving many adjustments and complications.

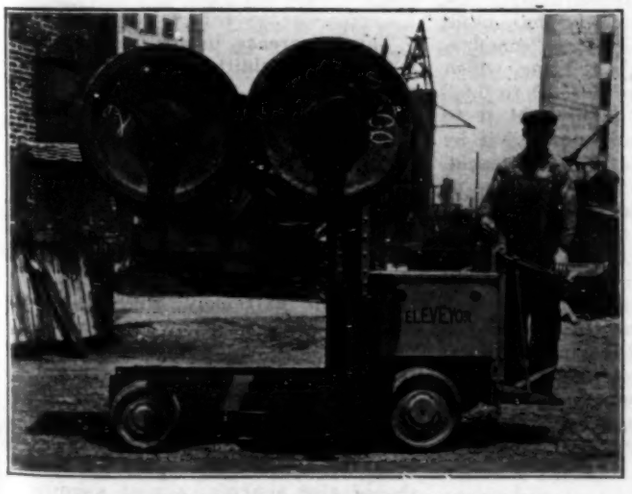


FIG. 2—ELEVEYOR WITH PLATFORM RAISED

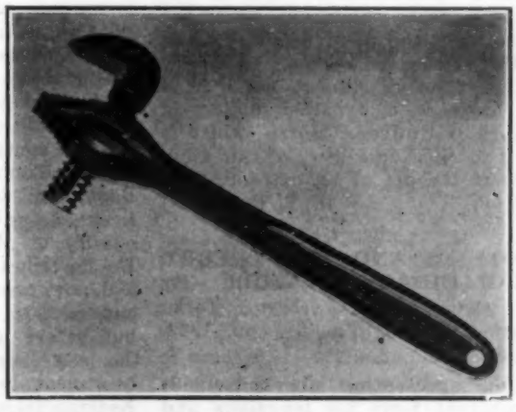
One of the new departures presented in this truck is the use of a chain hoist for elevating the platform. A chain hoist is constantly engaged, so that the load is safely held at all times. Its mechanism possesses great strength, few parts and high efficiency and is felt to be superior to gear train, planetary system, cable, or screw such as has been used in former designs of tiering trucks.

A summary of the advantages claimed for this truck comprises the following:

1. Exceptionally large platform and wheels.	For bulky material and rough roadways.
2. Platform spring suspension.	Relieves load and frame from injurious shocks.
3. Platform track construction.	Provides great strength and a short truck.
4. Parallel link drive axle suspension.	Provides ideal spring action with simplicity.
5. Battery compartment free of all overhead obstruction.	Battery easily watered or removed.
6. Shortest possible truck length for a given size platform.	Turns in close places.
7. Most efficient gearing in transmission and hoist.	Operates longer with given battery capacity.
8. Neutral return controller.	Facilities starting on a grade and keeps driver's hand on lever.

A New Pipe Wrench

Those who have had anything to do with plant construction or operation are likely to be familiar with the "Little Giant" line of screw plates, taps and dies. The Greenfield Tap & Die Corporation, of Greenfield, Mass., has recently added to this line the "Little Giant" pipe wrench, a cut of which is here shown.



This wrench is of the end opening type, like the familiar machinists' wrench. It is claimed that this construction makes the new tool particularly applicable to use in corners and other confined places.

Among the advantages claimed for this wrench are the small number of parts, there being only three; the unusual strength, combined with light weight; and the double set of teeth on the main jaw, which doubles the life of the tool.

This wrench will be made in 8, 10, 14, 18 and 24 in. sizes, the three smaller sizes being now procurable.

Book Reviews

THE PRINCIPLES OF ORGANIC CHEMISTRY. By *James F. Norris.* Second edition, 632 pages. New York: McGraw-Hill Book Company, Inc., 1922. Price $3.

There has been a tendency among authors of college text-books of chemistry to expand them into volumes of formidable size, and the reviewer feels that Professor Norris is to be congratulated on resisting this temptation.

The book contains about fifty pages more than the earlier edition, but the new matter which has been included will certainly add to the student's interest in the subject. The author has not hesitated to include a brief description of industrial processes as frequently as could be expected in an elementary work of this kind. Among the new subjects included, the reviewer notes the manufacture of isopropyl alcohol from petroleum still gases, some notes on the manufacture and toxicity of phosgene and its use as a war gas, a brief description of mustard gas and its methods of preparation, a brief reference to the Bucher process, the catalytic oxidation of benzene to maleic anhydride, the manufacture of ethylene glycol from ethylene and the intermediate ethylene chlorhydrin.

The chapter on dyes has been somewhat extended, and the chapter on proteins has been amplified and brought up to date as far as is consistent in a book of this kind. It is inevitable that the subject matter included in a text-book of this kind will be nearly identical with other books of the same scope and purpose. The quality which distinguishes works of this kind is the clearness of the exposition and in this particular case the interjection of many statements which cannot help but impress upon the mind of the student that the science of organic chemistry is a live, growing subject, not a dead one. There is a dynamic quality in this work of Professor Norris' which is difficult to inject in a work of this kind. It reflects the art of an extraordinary expositor. B. T. BROOKS.

PROTEINS AND THE THEORY OF COLLOIDAL BEHAVIOR. By *Dr. Jacques Loeb.* New York: McGraw-Hill Book Co., 285 pp. 1922. Price $3.

Besides presenting in convenient and coherent form his ingenious and extensive researches on proteins (chiefly gelatine, albumin and casein) which have appeared in journal articles over a long period, the author in this book gives many hitherto unpublished experiments to support his views.

The first part of the book "furnishes proof of the stoichiometrical character of the reactions of proteins"; the second part gives a "theory of colloidal behavior based on Donnan's theory of membrane equilibria." "Any rival theory which is intended to replace the Donnan theory must be able to accomplish at least as much as the Donnan theory—i. e., it must give a quantitative mathematical and rationalistic explanation of the curves expressing the influence of hydrogen-ion concentration, valency of ions and concentration of electrolytes on colloidal behavior and it must explain these curves not for one property alone but for all the properties, electrical charges, osmotic pressure, swelling, viscosity and stability of solution, since all these properties are affected by electrolytes in a similar way."

But "such an application of Donnan's theory would have been impossible without the stoichiometrical proof that proteins form true ionizable salts with acids and alkalis. What was at first believed to be a new type of chemistry—namely, colloid chemistry—with laws different from those of general chemistry, now seems to have been only an unrecognized equilibrium condition of classical chemistry; at least as far as the proteins are concerned. This does not detract from the importance of colloidal behavior for physiological and technical problems, but it completely changes the theoretical treatment of the subject." Evidently then, as the title indicates, Loeb accepts colloids and offers a theory of their behavior. His book should be read by all interested in the subject.

Because of the high reputation of the author, many scientists will be prone to accept his conclusions without submitting his experiments and arguments to critical examination. Your reviewer feels constrained therefore to point out what appear to him to be some basic errors, both experimental and rational, which strike at the very root of Loeb's conclusions.

Loeb's whole thesis is based on the formation of true ionizable protein salts—e. g., gelatine chloride and sodium gelatinate. This naturally assumes that gelatine is a definite chemical entity, which no one has ever demonstrated. In fact the existing evidence is to the contrary. Thus, the analyses of Levene, Skraup and von Biehler, Dakin, Bogue and others differ widely. But Loeb has failed to define exactly the *quality* of the gelatine he has used. He describes it (p. 35) as "commercial powdered Cooper's gelatine, which happened to have a *pH* of 6.0 to 7.0," but before using it he brought it to the isoelectric point and purified it by treatment with M/128 acetic acid. Nothing is stated of the percentage of gelatoses or of gelatones in the purified product, nor is the jelly-strength or mutarotation (after C. R. Smith) given, from which a rough idea of their percentage might be formed. The gelatine apparently lost 20 to 25 per cent during purification, which introduced a like error into some of Loeb's earlier experiments. (See e. g. Harvey Society address, *Science*, N. S., vol. 52, p. 451 (1920); *J. General Physiol*, vol. 3, p. 89 (1920); also the present book, (p. 58).

Again Loeb has failed in each case to define exactly the ash and moisture content of the gelatine used, both being essential (especially the latter) in fixing the percentage of gelatine in solution. C. R. Smith, *J. Am. Chem. Soc.*, vol. 43, p. 135 (1921) and Miss A. M. Field, *ibid.*, vol. 43, p. 667 (1921), had shown how to prepare ash-free gelatine, which is by no means identical with isoelectric gelatine. Loeb gives (p. 35) "a result of an ash determination made by Dr. D. I. Hitchcock on a sample of gelatine selected at random" from one of Loeb's stock solutions containing 12.69 per cent gelatine. The analysis showed about 0.1 per cent ash, apparently $Ca_3(PO_4)_2$. Loeb says this amount of ash is without influence, but since C. R. Smith has shown that Ca may exert a powerful influence, it would have been better had Loeb determined the ash of every specimen of gelatine the ash of *every* specimen of gelatine he actually used. The paper of Oakes and Davis (*J. Ind. Eng. Chem.*, vol. 14, p. 706, 1922) also shows the importance of "ash."

Loeb's experimental results are reported mainly in curves or graphs which your reviewer believes are incorrectly plotted and drawn. This is quite evident in the graphs of Chapter VI, where *equal* increments on the axis of abscissas are given M/2, M/4, M/8, M/16, M/32, etc. It is not so obvious in the other chapters where equal increments are given *pH* values of 1, 2, 3, 4, 5, 6, 7, etc., because most readers do not stop to consider the real meaning of *pH*. This abbreviation of Sorensen is an inverse logarithmic value deprived of its minus sign. The following table will give an insight:

pH value	Number of Times the H (or OH) Ion Concentration Exceeds That of Pure Water
1	1,000,000
2	100,000
3	10,000
4	1,000
5	100
6	10
7	i.e. conc. H and OH = 10^{-7} mols per liter. . . . . 0 (pure water)
8	10
9	100
10	1,000

Thus, decrease in *pH* value means increase in acidity, not in an arithmetical but in a logarithmic ratio. Curves plotted on an arithmetical basis, as are Loeb's, are thus logarithmically compressed and deviations there appearing as experimental errors may really obscure cusps or inflections. Loeb's method of plotting is furthermore apt to make the reader forget that values of about *pH* 6 to *pH* 7 represent an extremely slight acidity. *N*/10 HCl has a $pH = 1.07$ and ordinary distilled water in the laboratory (containing CO_2) has a $pH =$ about 5.5.

Therefore values of about *pH* 2 to *pH* 3 represent a very high acidity. Curves which Loeb shows with equal branches, resembling parabolas, should rise sharply, almost asymtotic

to the *pH* 4.7 ordinate, and after turning, gradually approach to axis of abscissas. Some other points may be epitomized as follows:

The view (Chapter II) that proteins fix acids by their free NH_2 groups and acids by their free COOH groups, while simple, does not accord with the observation that deaminized gelatine (Blasel and Matula) and highly hydrolyzed gelatine (T. B. Robertson) both fix about as much acid as the original gelatine. Jordan Lloyd and Mayes (*Proc. Roy. Soc.*, B. vol. 93, p. 69, 1922) give additional evidence that disproves this appealing but incorrect chemical explanation.

Loeb's interesting qualitative experiments (Chap. II) show, as Bancroft remarked, that acid or plus-charged gelatine (*pH* less than 4.7) fixes only anions, while alkaline or minus charged gelatine (*pH* less than 4.7) will fix only cations, which is only to be expected. Clay or fine silica might act similarly.

His quantitative experiments (Chap. IV) show e. g. that the number of c.c. of different *N*/10 acids required to bring isoelectric gelatine to the same *pH* varies roughly in accordance with the *pH* (available or effective acidity) of each acid at that *pH*. Thus at *pH* 3 the effective acidity of HCl and H_2SO_4, oxalic, and phosphoric acids are about 3, 2 and 1 respectively and Loeb found that to bring one gram of isoelectric gelatine to *pH* 3, it took (in c.c. of *N*/10 acids) 7.2 HCl, 7.5 H_2SO_4, 13.15 oxalic, 20.7 phosphoric. Most of his experiments stop at about *pH* 2, which represents an acidity equal only to *N*/100 HCl (*pH* 2.02).

Assuming that deviation from the curves is due only to experimental errors, these results, while not inconsistent with the view that chemical compounds have been formed, may simply be due to the fact that within the *pH* range of the experiments, gelatine has, at each *pH*, a more or less definite free adsorptive surface and adsorbs acids in proportion to their free field of force. The fact that material chemical changes (see above) in gelatine do not affect its acid combining capacity appreciably favors the adsorption rather than the chemical view. Even W. B. Hardy (see Loeb, p. 9), who latterly expressed belief in salt formation, stated that the reactions are not precise. No one has ever prepared chemically pure gelatine, and estimates of its combining weight vary from about 768 (Proctor and Wilson) to about 96,000 (C. A. Smith). Jordan Lloyd gives chemical evidence that it cannot be less than about 10,300 and Loeb apparently believes it to be between 12,000 and 25,000. As Hardy indicates, it depends upon conditions, and your reviewer believes it will also vary with the kind of gelatine. It is still to be demonstrated that these compounds possess the definiteness which is at present connoted by the expression "chemical compound."

The *pH* (that is, the effective reaction) of acids is controlled by the specific nature of their anions; the *pH* of alkalis by the specific nature of their cations. The *pH* of *N*/100 HCl is 2.02, but the *pH* of *N*/100 acetic acid is 3.37. Why? Because in aqueous solution Cl releases H+ more readily than does CH_3COO-. This means that HCl is a strong acid and acetic a weaker one.

Hofmeister, Ostwald and M. H. Fischer observed the effect on proteins, of *equal molar concentrations* of various acids and alkalis and then compared the consequences of their *differing pH or effective reaction.* Loeb, on the other hand, uses enough of various acids and alkalis to make their *effective reactions* (*pH*) *equal* and then compares the *varying quantities required.* What he considers "practical identity"—e.g., in curves of Figs. 19 and 20 (pp. 79 and 80)—may appear differently if the curves are correctly plotted. He even comments (p. 80) on the anomalous behavior of acetic acid, probably caused by sol formation (see below).

That the problem of the swelling of gelatine in acids is not as simple as a Donnan equilibrium formula would indicate is evident from the work of A. Kuhn (*Kolloidchem. Beihefte*, vol. 14, p. 202, 1921), who found it to be dependent upon four factors:

A (*1*) Hydration (simple swelling)
B (*2*) Sol formation (incidental peptization)
(*3*) Hydrolysis
C (*4*) Dehydration (flocculation)

The maximum is reached when, with increasing concentration of acid, hydration is overbalanced by sol formation and hydrolysis. Probably it was sol formation that caused Loeb to lose about 20 per cent of his gelatine in his earlier experiments (p. 58). Since sols (as Graham distinctly pointed out) do diffuse, albeit though slowly, we have here another factor working contrary to the Donnan equilibrium. Experimenting with 50 organic acids, Kuhn could not decide if the combination was chemical or adsorption.

Loeb argues (p. 16) that "if the addition of a salt to a protein solution diminishes its osmotic pressure by causing an increased formation of aggregates, the same addition of salt should increase the viscosity of such a solution. The reverse, however, happens, the viscosity of the solution being decreased by the addition of salt." Loeb here entirely overlooks the existence of the zone of maximum degree of colloidality. (See *J. Am. Chem. Soc.*, vol. 43, p. 434, 1920.) Viscosity does often increase as particles aggregate, as in cooling gelatine solutions, but viscosity may also increase as particles are dispersed, as when cream is homogenized, or karaya gum dispersed.

Loeb makes the sweeping assertion (p. 278) that "there is only one source of colloidal behavior—namely, the Donnan equilibrium—at least as far as the proteins are concerned." Donnan can hardly believe this, for Loeb quotes him (p. 22) as saying (*J. Chem. Soc.*, vol. 105, p. 1963, 1914) that in the comparatively simple case of a copper ferrocyanide membrane and potassium ferrocyanide solutions, "the phenomena are not so simple as supposed in the theory." The great danger of applying mathematics to chemical and physical problems lies in the fact that we may be blinded by the logical perfection of this mere tool and make erroneous assumptions, or else neglect important factors which so often crop up unexpectedly in nature. The fact that some of the assumptions involved in Donnan's equations do not apply to gelatine has been pointed out by Jordan Lloyd—e.g., the gelatine "ion" does diffuse. The basic assumption that a true hydrolyzable "salt" is formed is, to say the least, doubtful.

A word in defense of Thomas Graham is necessary, for his classic papers are seldom consulted in the original. Loeb states (p. 275): "Graham had suggested the distinction between colloidal and crystalloidal substances, but it was found later that one and the same substance—e.g., NaCl, may behave when in solution either as a crystalloid or a colloid. It was then proposed to drop the distinction between colloidal and crystalloidal substances, and distinguish between the colloidal and crystalloidal state of matter." This is surprising, for Loeb on page 1 quotes from Graham the very paragraph wherein the word "colloid" was born; the particular sentences of Graham are: "As gelatine appears to be its type, it is proposed to designate substances of the class as colloids and to speak of their peculiar form of aggregation as the colloidal condition of matter. Opposed to the colloidal is the crystalloidal condition. Substances affecting the latter form will be classed as crystalloids. The distinction is no doubt one of intimate molecular constitution." Further on in the same paper, "Liquid Diffusion Applied to Analysis" (1861), Graham says: "The mineral forms of silicic acid, such as flint deposited from water, are often found to have passed during the geological ages of their existence from the vitreous or colloidal into the crystalline condition (H. Rose). The colloidal is in fact a dynamical state of matter, the crystalloidal being the statical condition." And still further: "The inquiry suggests itself whether the colloid molecule may not be constituted by the grouping together of a number of smaller crystalloidal molecules and whether the basis of colloidality may not really be due to this composite character of the molecule." So Graham did know that the same substance can exist in both colloidal and in crystalloidal state. Modern research has fixed dispersion into particles between about 100 $\mu\mu$ and 5 $\mu\mu$ as the criterion of the colloidal condition, and the particles may be crystalline or consist of random clusters. But these statements of Graham still hold true.

It is to be regretted that Loeb did not review, discuss and consider the results of many important workers in

this field. Thus he does not mention Blasel and Matula, Arisz or Jordan Lloyd and dismisses C. R. Smith with mere mention in a footnote (p. 36) and Wo. Ostwald and Martin H. Fischer in a brief quotation from Zsigmondy (p. 76). He quotes and demolishes Pauli, with whom Ostwald and Fischer likewise disagree. All told, Loeb's book is written from the standpoint of an advocate pleading his cause, rather than from that of a judge deliberately weighing all the evidence, and this brings inherent weakness. JEROME ALEXANDER.

Recent Chemical & Metallurgical Patents

American Patents

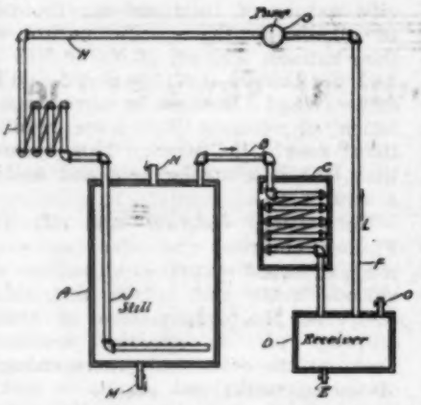
Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Tar Distillation—In the distillation of tar, the progressive decomposition which takes place results in the formation of "free" carbon and pitch. The greater the amount of these products formed the less the amount of tar oils recovered and hence, the less the value of the products. For the purpose of assuring the highest possible yield of these more valuable tar oils, John M. Weiss of New York has invented the distillation method shown in the accompanying drawing.

The basis of this process is the agitation of the tar during distillation with a large amount of some gas chemically inert toward tar and containing little if any oxygen. The gases available include nitrogen and CO_2, which are the principal constitutents of air after the oxygen has been used. This type of agitation has been found to increase the oil yield materially.

For best results an amount of gas not less than 1 cu.ft. (measured at ordinary temperatures and atmospheric pressure) per minute per 100 gal. of original material introduced in the still should be recirculated and an amount greater than 20 cu.ft. per minute per 100 gal. of original material to be distilled does not seem to present any substantial advantage in obtaining a higher yield of oil than the lesser amounts. The gas should also be heated before being introduced into the still.

As illustrative of how the process can be applied to tar-distillation reference may be made to the appended illustration. A still *A* heated by any suitable means and provided with a drawoff *M* and a filling line *N* is connected by a pipe *B* to a condenser *C*, which delivers into a receiver *D* with a drawoff *E*. From the top of the receiver a pipe *F* leads to a pump *G* and thence by a pipe *H* to a superheater *I* and by the pipe *J* to the bottom of the interior of the still communicating with it through a perforated pipe. The inlet pipe *O* serves as a vent or for the introduction of gas into the system. The arrows *L* show the direction of gas flow.



The still is charged with the tar to be distilled and the pump *G* started and a suitable gas is drawn in through pipe *O* until the system is filled. The system is then closed and heat applied, the gas being circulated at the desired rate. Distillation starts and is continued with the circulation maintained until the residue in the still is of the desired consistency, the volatile constituents being carried off by the circulating gas from still *A* and condensed in the condenser *C*. The heat and gas circulation are then discontinued and the residue is removed from the still *A*.

The following results illustrate the advantage which may be obtained by the use of this process in the distillation of a byproduct coke-oven tar. The particular tar used had a free carbon content of 8.5 per cent. Passage of gas in all cases was made at the rate of about 15 cu.ft. per minute per 100 gal. of material introduced in the still.

	Per Cent by Wt., Oil Obtained	Per Cent by Wt., Pitch Obtained.	Pitch Air Melting Point, Deg. F.	Pitch per cent Free Carbon
Distillation without agitation	40.1	57.8	280	40.7
Air used not recirculated	33.0	63.0	286	35.1
Nitrogen recirculated	52.0	46.4	277	27.2
Carbon dioxide recirculated	51.2	46.7	270	28.2
Mechanically stirred	40.0	57.9	300	46.5

(1,418,893—John M. Weiss, assignor to The Barrett Co., June 6th, 1922.)

Retort—In many manufacturing operations where retorts, furnaces and the like are subjected to a high temperature it is desirable to employ iron or other similar relatively cheap and plentiful metal as the retort or furnace material. For example, in the manufacture of coal gas, oil gases and in certain processes employed to effect the fixation of atmospheric nitrogen, iron retorts or furnaces would be highly desirable were it not for the fact that corrosion is quite rapid at the high temperatures required in these processes. The rapid deterioration and destruction of retorts or furnaces consisting of iron or other similar metal involve in many cases a prohibitive maintenance cost and a consequent or necessary elimination of iron as a furnace material for such purposes.

This invention consists in coating the iron or other cheap basic material with a coating which offers substantial resistance to the corrosive action of the gases generated. In this way the life of the retort is greatly prolonged, and the upkeep expense appreciably reduced. An alloy of nickel and chromium in the proper proportions with or without the addition of smaller quantities of other metals serves as a protective coating for the iron retort or furnace. Such an alloy may consist of 85 per cent nickel and from 10 to 15 per cent chromium, the variations in the latter depending upon the amount of impurities which may be present such, for example, as iron, manganese and carbon. This alloy should be sprayed on the base metal in a molten state or coated on in some other form so that a uniform, dense and compact coating is formed over all surfaces of the retort. (1,422,878; Floyd J. Metzger, of New York, N. Y., assignor to the Air Reduction Co., of New York. July 18, 1922.)

Refractory Silica Brick.—It is a well-known fact that ordinary refractory silica bricks show a tendency to swell or expand when used in high-temperature furnaces, this gradual increase in volume resulting in disintegration and destruction of the furnace structure. In the endeavor to do away with this disadvantage, it has been discovered that a long-continued baking process at a temperature approximately 1,400 deg. C. obtains at least the partial transformation of the quartz in the brick material into tridymite and results in the production of a brick of approximately constant volume. This process is expensive, however, and the present invention is offered as a cheaper and surer way of accomplishing the same end.

In this process, small quantites of a phosphate or similar material such as boric, tungstic or molybdic acids or their salts are introduced during the process of mixing the quartz with the clay cement or lime. If, then, the brick is heated to a temperature of about 1,300 deg. C. for about 8 hours, it is found that most of the quartz is transformed into allotropic forms of lower specific gravity.

It is claimed that in this way refractory silica brick may be manufactured from quartz which will have substantially constant volume under high temperatures. (1,420,284; Orazio Rebuffat, Naples, Italy, assignor to Pomilio Bros. Corporation, New York. June 20, 1922.)

Gas Producer—The producer is a downwardly widening chamber provided at the base with a steam-generating space located laterally or in an annular ring above the lower section of the combustion chamber. The air for combustion is so directed past the outlet of this steam-generating chamber as to carry moisture into the fuel bed with it. The object sought is durability of construction and higher gas production efficiency because of the generation of small quantities of water gas mixed with the producer gas. (1,414,109; F. M. E. Blass. April 25, 1922.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields—Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Last Minute Changes in Tariff Bill Boost Items on Chemical Schedule

Senate Passes Fordney-McCumber Bill by Vote of 48 to 25—Bursum Amendment Replaces Dye Embargo—Flexible Provision Extends to 1924

WHEN the Senate concluded its consideration of the tariff bill in committee of the whole and took up the measure in the Senate proper, no further vote on the chemical embargo feature of the bill was taken. This was due to the fact that the necessary votes to reverse the decision reached in the committee of the whole could not be counted. Apparently three votes were lacking to insure the adoption of the embargo. It then was decided that the Bursum amendment would be the next best thing and the friends of the chemical industry reluctantly decided not to risk another roll call on the embargo.

Some are of the opinion that the Bursum amendment is preferable to an embargo, since it will last through the life of the act and obviates the necessity of making the whole fight over again at the end of the year.

While the average of the specific rates are admittedly high in the bill as a whole, Chairman McCumber of the Finance Committee contends that the average ad valorem rates are lower than in any Republican tariff bill enacted heretofore. The Senate materially reduced the rates prescribed in the House bill, with the exception of those on coal-tar products and those in the agricultural schedule. These rates were increased materially.

Flexible Provision

One of the very important phases of the bill is its provisions for flexible tariff. This is the first time any elasticity in tariff rates has won the approval of either house. While the amendment proposing to enlarge the Tariff Commission did not prevail, the commission is authorized to hold hearings and to conduct continuous investigations with the idea of remedying any inequities that may be found in tariff rates. The Tariff Commission will submit its finding of facts to the President, who is empowered until July 1, 1924, to change rates, provided that no change, either up or down, is to exceed 50 per cent. The date of July 1, 1924, was selected by the majority party so that in the event of a change of administration the power would not be conveyed to a Democratic President.

The most drastic change made by the Senate in the tariff bill came in the final week when an amendment proposed by Senator Bursum of New Mexico was accepted, increasing the rates of duty on coal-tar products and changing the basis of valuation on these dyes and chemicals from foreign to American.

Acceptance of the Bursum amendment in the committee of the whole was by a vote of 38 to 23 and this action was sustained by a vote of 39 to 31 when the bill was reported to the Senate proper. This is in contrast to the vote of 32 to 38 by which the proposed extension of the dye embargo failed of approval July 15.

Dye Rates Increased

The Bursum amendment increases the duty on coal-tar intermediates from 50 per cent ad valorem and 7 cents per pound based upon foreign valuation to 75 per cent ad valorem and 10½ cents per pound based upon American valuation. It increases the duty on coal-tar chemicals and dyes from 60 per cent ad valorem and 7 cents per pound on foreign valuation to 90 per cent ad valorem and 10½ cents per pound on American valuation. The increase amounts to more than 100 per cent, due to the change in figures and in the basis of valuation. It is provided that whenever there is no competitive American article affording a means of computing the American valuation, the ad valorem rate shall be based upon the foreign value or the export value, whichever is the higher. A proviso was included that in the exercise of the powers to change rates given to the President in the elastic tariff sections of the bill, no increase in rates may be made on coal-tar products.

Senators Moses and Smoot vigorously opposed the Bursum amendment, which was advocated by its sponsor and by Senators Wadsworth, Sterling, Lodge, Ransdell and Jones. Debate at times waxed warm, especially during the consideration in committee of the whole.

Senator Wadswoth introduced a letter written by Secretary of War Weeks, urging protection of the chemical industry of the United States as a matter of national defense. The letter, addressed to Senator McCumber, chairman of the Finance Committee, advocated extension of the embargo, but was read to the Senate in connection with the fight for higher rates.

Senator Moses of New Hampshire had previously demanded a separate vote on these rates before their final adoption, but when the matter was presented he declared that in view of the very decisive vote he would offer no further objection to their retention. His withdrawal from the fight against the dye provisions in such manner was the cause of much speculation and apparent discomfiture on the part of the proponents of the embargo provisions.

Embargo Abandoned

With the high rates of duty written into the bill it became apparent from the start that all chances of the embargo being adopted were eliminated. The rates were denounced on the floor of the Senate by varions Senators, but it was evident that the change of front was due to the knowledge that the flexible tariff provisions of this same measure will operate to lower excessive levies on many coal-tar products.

Senators Sterling and Lodge both contended that the increases were necessary to protect the American chemical industry from the standpoint of national defense. They asserted that under the elastic tariff provisions of the bill, the President undoubtedly would find it necessary and advisable to increase the rates on coal-tar products, but that an investigation by the Tariff Commission, necessary to present the facts to the President, would consume 8 or 10 months, then 60 days would have to elapse before a proclamation increasing duties could become effective and that in the meanwhile there would be a flood of German imports which would put the American industry out of business.

Acetaldehyde and Related Products

Several important changes in the chemical schedule of the tariff bill were made before the measure was passed by the Senate and sent to conference. After having first accepted an amendment by Senator France reducing the duty on acetaldehyde and allied chemicals from 6 cents per pound and 30 per cent ad valorem, to 20 per cent ad valorem, the Senate on motion of Chairman McCumber of the Finance Committee two days later reversed itself and restored the higher rate. Senator France, in securing adoption of his amendment, stated that these chemicals are not produced in the United States. In securing reversal of the action, Senator McCumber declared that there is production of these chemicals. Acetaldehyde and its related products—aldol, aldehyde ammonia, butyraldehyde, crotonaldehyde and paracetaldehyde—are finding an increasing use as intermediates, in manufacturing pig-

(*Continued on page* 375)

Chemical Foundation Defended in Senate

Senators Underwood and Wadsworth Express Support in Dye Tariff Discussion

As a result of the publicity which has been given to the Chemical Foundation matter and the speeches made in the Senate by Messrs. Underwood and Wadsworth, it is believed that the public has been convinced that there are two sides to the case. The fact that the Foundation has been defended by outstanding Senators of each party has had the effect of indicating that the defense is not being made for partisan political reasons.

Senator Wadsworth brought his defense of Francis P. Garvan, president of the Foundation, into his spirited support of the Bursum amendment to the dye schedule. He declared that if ever there was a deliberate attempt to break down and weaken the power of American self-defense, it has been made in connection with the American organic chemical industry. Senator Wadsworth's words were, in part, as follows:

> From what I have been able to learn of the history of organic chemistry in this country, especially in the dye industry, prior to our entrance into the World War, during our participation in the war and since the war, I am convinced that long before the United States actually declared a state of war the German Government and the cartel were in effect, although slyly, waging war against the peace and the safety of the people of the United States. We did not wake up to that situation until we ourselves got into the fight. The letter of the Secretary of War points out very briefly—all too briefly, according to my view—but sufficiently for the purposes of this discussion the predicament in which this republic of ours found itself when we were called upon to engage in our own defense.
>
> We went into the war and we learned the lesson at the cost of billions of dollars and many thousands of lives. We participated in the great victory and at the conclusion of the contest we asked for no territory; we asked no reparations; we asked for nothing of value to be taken from the vanquished, and we received nothing.
>
> We have the opportunity, as the result of the contest, an opportunity seized upon legally to maintain our public health with our own resources and without depending upon any foreign government or any foreign cartel, corporation or trust. We have secured the opportunity—and have secured it legally and properly as a result of our sacrifice and our efforts in the war—to maintain our national defense without depending upon any other nation, government, trust or cartel of any kind whatsoever. That is the prospect which confronts the American people today.
>
> It does not do, Mr. President, in discussing this matter, to drag the names of American citizens into the discussion and accuse them of dishonest motives because, forsooth, they take an interest in the perpetuation of this chemical industry here in America. It does not do, Mr. President, to bring inferences and insinuations against Francis P. Garvan; not by any means. I care not what his politics are; I understand he is a Democrat; I have known him since 1895 and known him well. He is an honest man, and he has no thought in his mind or motive in his heart except the safety of this country.
>
> I shall not discuss upon this occasion the wisdom or the unwisdom of the policy adopted by the last administration in the handling of the patents covering the dyes through the Chemical Foundation as trustee; that is not a part of this discussion; but I know full well, if I know anything about the psychology of this situation, that the attack upon the Chemical Foundation had a most material influence upon the votes cast on the question of the tariff on dyestuffs. It is for that reason that I deplored it at the time, although not publicly, for I had no opportunity to do so, but I deplore it now. It is not the question at issue.
>
> This organic chemical industry lies at the bottom of nearly everything we use. I firmly believe that the progress of the race from now on will be measured more by the progress in organic chemistry than in any other human effort. I believe that in organic chemistry lies the solution of the secrets of the past and of the future. I believe that its establishment and maintenance in this country, even under an embargo, mean the happiness, the progress, and the security of 100,000,000 people.
>
> I want to see the chemical laboratories of this country multiplied again and again. They cannot be multiplied, they cannot be maintained, no student will attempt to attend their courses, unless there is a chemical industry in which those students upon graduation may find a career.
>
> The two things—research in the laboratory and the successful conduct of a chemical industry—go hand in hand. Neither can proceed without the other.

The New York Senator concluded by expressing regret at the defeat of the embargo and a plea for the passage of the Bursum amendment.

Steel Treaters Announce Detroit Convention Plans

A preliminary program has been issued for the joint meeting of the American Society for Steel Treating and the American Drop Forging Institute, Oct. 2 to 7. The exposition of equipment will be held in the General Motors Building, and is open each day from 10 a.m. to 10 p.m. Technical sessions will be held in adjoining rooms, as follows:

Monday, Oct. 2, 2:00 p.m., general business meeting of the society.

Tuesday, Oct. 3, 10 a.m., Carburizing; 4 p.m., Metallurgical Education; 9:30 p.m., smoker.

Wednesday, Oct. 4, 10 a.m., General Heat-Treating; 2 p.m., Drop Forging; 4 p.m., Round Table on Practical Hardening; 9 p.m., carnival, frolic and dance.

Thursday, Oct. 5, 10 a.m., Tool Steels; 2 p.m., Alloy Steels; 4 p.m., Round Table on Practical Hardening; 7 p.m., banquet at Hotel Statler.

Friday, Oct. 6, 10 a.m., Non-Ferrous Session; 2 p.m., research.

A number of Detroit manufacturing establishments have extended an invitation to inspect their operations. Parties will be formed, and leave the General Motors Building daily at 10 a.m. and 2 p.m. During the week the committee on hardness testing of the National Research Council will also hold a symposium on hardness testing.

Accuse Janitor of Platinum Theft From Bureau of Standards

Responsibility for recent thefts of platinum from the laboratories of the Bureau of Standards is thought to have been fixed by the arrest of a negro janitor. Most of the stolen platinum was recovered from a Washington jeweler, to whom the janitor is said by the police to have sold the platinum in the very small amounts which he is said to have taken from time to time.

Rapid Strides in German Industrial Standardization

American Engineer Reports Intense Interest and Hearty Support of Standardization

"The day may not be far distant when American manufacturers will receive inquiries from oversea countries to furnish goods according to the German national standards, and it behooves us to plan in time to meet such conditions."

This statement is contained in a communication to the American Engineering Standards Committee from Oscar R. Wikander, an American engineer, who has just returned from Germany, where he represented that committee in conferences concerning the international standardization of ball bearings.

Describing the great strides in standardization that have been made by German industries, Mr. Wikander said:

"There is no doubt in my mind that one of the main reasons why forward-looking Germans force their standardization work is because they want to introduce German standards in the great importing countries, and possibly in the whole world. Holland, Switzerland, Austria, Sweden and many other European countries follow the German lead very closely.

"It was only a few years ago that the Normenausschuss der Deutschen Industrie, an organization corresponding to our American Engineering Standards Committee, was formed, but the amount of work which it has already accomplished is stupendous. The Normenausschuss has already issued several hundred sheets of approved standards, and about twice as many are already published as proposed standards. This enormous output of the German organization has led many to believe that it was merely a factory producing 'paper standards' and that its work was not to be taken very seriously. A personal investigation convinced me that this is not the case, and I found that the great output of standards was merely due to the enormous efforts put forth and to the enthusiasm of the great majority of the interested parties.

"This enthusiasm is due to a more or less general recognition, created under the pressure of war conditions, of the great economic value of standardization and to the very generally accepted opinion that a standardized industry would be one of the strongest weapons in Germany's struggle for economic rehabilitation."

Centrifugal Casting Equipment Installed at Pipe Works

The United States Cast Iron Pipe & Foundry Company has recently equipped its North Birmingham plant with four machines to be used in the manufacture of cast iron pipe by the de Lavaud centrifugal method.

It is stated that this type of cast pipe can be made much lighter than pipe made by the old method and at the same time will stand greater pressure.

Denies Fraud in Sale of Nashville Powder Plant

Purchasers of Old Hickory Smokeless Plant Plead Not Guilty of Conspiracy to Defraud Government

Ernest C. Morse, former director of sales of the War Department and now president of the Foreign Sales Supply Co. of New York, pleaded not guilty in the District of Columbia Supreme Court to the indictment charging conspiracy to defraud the government in connection with the sale of the Old Hickory plant at Jacksonville, Tenn.

Over the protest of government counsel the court granted the defendant until Sept. 20 to file a motion to quash the indictments. He furnished $5,000 bail on each of the two charges.

Everly M. Davis, president of the E. M. Davis Chemical Co., and Alexander W. Phillips, associated with Davis, both of New York, who were indicted in the Old Hickory case with Morse, were also arraigned and pleaded not guilty.

Attorney Mayer, who accompanied Morse to Washington, later made the following statement:

"Mr. Morse appeared today in the United States Court and pleaded not guilty to the indictments found against him. At the time of the investigation by the Graham committee, Mr. Morse appeared voluntarily, waived all immunity and under oath answered all questions of the members of the committee.

"It is regrettable and surprising that Mr. Morse, who occupied the position of director of sales of the War Department and who, under instructions of the Secretary of War, directed the sale of more than two and one-half billions of dollars' worth of government property, should not have been called before any other government agency or official investigating the sale of war surplus.

"The indictments having been found under such circumstances, Mr. Morse is obliged to wait until the trial of the indictments, to place before the public facts which will completely vindicate him of the charges made."

Open-Hearth Patent Complications Relieved

All patents and patent applications relating to combustion in regenerative furnaces, known as the McKune, Danforth and Engler systems, have been assigned to the Union Trust Co., of Cleveland, by the Miami Metals Co., Blair Engineering Co., and Arthur G. McKee & Co. Acting as trustee, the Union Trust Co. has appointed the Blaw-Knox Co. of Pittsburgh agent for the exclusive sale and manufacture of all equipment by these patents. This consolidation will assure to the steel industry the best that has been developed under all of the above mentioned basic patents, combined in one design, and will also remove the possibility of any patent interference in the use and operation of these equipments.

American Engineers Represented at Rio de Janeiro Exposition

The appointment of Calvin W. Rice, secretary of the American Society of Mechanical Engineers, as official delegate to the Engineering Congress to be held in connection with the International Exposition at Rio de Janeiro is announced at the national headquarters of the society in New York City. Mr. Rice, who goes as the emissary of organized engineering in the United States, and who for purposes of representation at the Congress has been elected an honorary vice-president of the society, will sail from New York Aug. 23 on the steamship Pan-America, which will convey Secretary of State Charles E. Hughes and his party to the Brazilian capital.

Mr. Rice's journey was called by officials of the society the opening of a new chapter in international relations among engineers. For many years, it was stated, this society has been active in laying the groundwork of a close union of thought and effort among the engineers of the world as a part of an elaborate plan of public service which is being gradually linked to the technical activity of the organization. In addition to the American Society of Mechanical Engineers, Mr. Rice will represent at the Congress the Federated American Engineering Societies, the American Institute of Electrical Engineers, the Engineering Foundation, the John Fritz Medal Board, the Engineering Division of the National Research Council, the Engineers' Club of New York City and other organizations.

A dinner in honor of Mr. Rice was given at the Engineers' Club, New York City, Aug. 21. Distinguished engineers, publicists and educators from many cities were present. John W. Lieb, vice-president of the New York Edison Co., acted as the toastmaster. The committee of arrangements included Charles F. Rand, chairman of the Engineering Foundation; W. F. M. Goss, president of the Railway Car Manufacturers' Association, and Roy V. Wright, of the Simmons-Boardman Publishing Co.

Chemical Warfare Gas Used as Fumigant

The work of the Chemical Warfare Service on the use of cyanogen chloride as a fumigant for ships and on the use of toxic materials in anti-fouling paints was described in these pages July 5, 1922. It was stated that this work was done in co-operation with the navy's marine biological laboratory at Beaufort, S. C. This statement was in error, as the laboratory is located in Beaufort, N. C.

The work in question was under the direction of Captain H. Williams of the Bureau of Construction and Repair, Navy Department, Washington, D. C. Captain Williams is a specialist on the use of toxic materials in anti-fouling paints.

Predicts Growth of Chemical Export Trade

C. R. DeLong, Chief of New Chemical Commodity Division, Optimistic on Prospects for Development

Expressions from American consuls in many countries as well as from other agents of the Department of Commerce, coupled with conclusions being reached in the course of economic studies being made at Washington, lead C. R. De Long, chief of the Chemical Commodity Division, to predict a gradual expansion of the chemical export trade. He expects American manufacturers to hold many of the markets supplied by them during the war and expects to see them compete successfully with the Germans in many fields. He does not believe that German competition in Latin America and in some other countries is as formidable as many think.

As internal readjustment in Germany catches up with the depreciated mark, German manufacturers will have to advance their prices, but judging from the reports on file in Mr. De Long's office, purchasers of chemicals in many countries have had unfortunate experiences with materials of poor quality and are more ready than ever to listen to quality arguments. Mr. DeLong thinks the danger from retaliatory duties, likely to grow out of the passage of the pending tariff bill, have been over-played. Since practically all countries have been forced to increase their tariffs recently, there is a much more general realization of the need for such action.

Plans of New Division

One of the first steps Mr. DeLong will take in the effort to make his division serviceable in the development of the export trade will be to obtain the appointment of advisory committees with whom he can keep in close contact. He will ask each individual trade concerned with exports to designate such a committee. At the present time, the lists of firms engaged in the exportation of chemical commodities are being revised carefully so that advance notices of probable needs abroad may be sent to them.

Plans now are being formulated for a statistical service covering those commodities where the need is apparent. The great mass of reports which reach the department daily from all parts of the world will be carefully scanned for current information which has a bearing on the demand for chemicals. In addition special economic studies of purely chemical interest will be undertaken from time to time. In some cases this will cover the world situation as it pertains to some chemical commodity and in others the possibilities of extending the market for American chemicals in a single country will be studied.

A number of important industrial groups have already offered their co-operation in this work and Mr. DeLong is hopeful that the industry will stand squarely behind the new division.

Electrochemical Society Meeting Promises Well

Symposiums on Electrodeposition and Industrial Heating Features of Technical Sessions

Final arrangements for the forty-second general meeting of the American Electrochemical Society, at Montreal, Que., are being made and indications are that the meeting will be a success.

The meeting will be opened by President Schluederberg on Thursday morning, Sept. 21. The technical program will include the presentation and discussion of papers on electrolysis and electroplating. The recently organized division on electrodeposition, of which G. B. Hogaboom is chairman, will be well represented and take active part in the discussion of these papers. One of the papers of the Thursday morning session will deal with the physical properties of electrolytic iron—a product which is being turned out commercially, contrary to all predictions of 10 years ago. There will also be papers on zinc, brass and other metals.

Industrial Heating Symposium

On Thursday afternoon and Friday morning a very interesting symposium on "Industrial Heating" will be in progress. The electrothermic division, of which Bradley Stoughton is chairman, held a most successful symposium on "Electric Cast Iron" at the Baltimore meeting last April, and will be in charge of this discussion. Twelve papers especially prepared for this session and dwelling on industrial heating in electric furnaces, other than fusion and melting furnaces, will be open for discussion. There will be papers on the following subjects: "History of Industrial Heating," "Principles of Design of Furnaces," "Comparison of Fuel Costs in Different Types of Electric Furnaces, and With Combustion Furnaces," "Resistor Materials," "Specific Heats," "Electric Conductivity of Insulating Materials at Industrial Furnace Temperatures," and "Heat Transfer."

An excursion to Shawinigan Falls has been arranged, affording members a rare opportunity to inspect the various industrial plants of one of the most progressive centers on the continent.

A popular lecture on the "Progress in Physical Science" is scheduled for Thursday evening. Section Q will be in charge of an old-fashioned smoker on Friday evening.

Headquarters for the meeting will be the Hotel Windsor.

Hoover Denies Report of Metric System Indorsement

Wide publicity has been given a news article to the effect that Secretary of Commerce Hoover has indorsed the metric system. Mr. Hoover states that he is at a loss to understand how such a report originated. He has not indorsed the compulsory use of the metric system, he says.

Manufacturing Chemists' Association Meets

The regular monthly meeting of the Manufacturing Chemists' Association was held in New York, Aug. 16. The association's committee on standardization announced that its report is in preparation and will be printed within a few weeks. The practicability of glass-lined steel carboys for acid shipment was discussed and referred to a committee for further consideration.

Free Port Provision Part of Tariff Bill

Establishment of Free Entry Ports for Reshipping Seems Assured by Senate Support

Establishment of foreign trade zones at a number of American ports practically is assured by the action of the Senate on Aug. 16 in adopting, with practically no opposition, an amendment to the tariff bill which would authorize the creation of such zones. The plan for the so-called free port has been denounced by ultra-protectionists as a free-trade scheme. To meet some of the objections voiced against the proposal, the Senate committee eliminated from the original amendment the authority to establish manufacturing enterprises within the free zone. It will be possible, however, to store, exhibit, break up, repack, assemble, distribute, sort, refine, grade, clean, mix and otherwise manipulate foreign or domestic merchandise in an area where no compliance with the laws and regulations governing the entry of merchandise will be required.

Vexations of Custom House

Under existing law any goods landed in this country must pass through the Custom House. If they are re-exported 99 per cent of the duty paid is refunded. In addition to the loss of 1 per cent of the duty, there is the more important consideration of vexatious and costly delays in complying with the red tape which accompanies entry through the Custom House and the subsequent dispatch of the foreign goods after they have been mixed with domestic merchandise or assembled in different forms.

Should Aid Shipping

The delays and annoyances of this procedure were such as to discourage almost entirely any handling of foreign merchandise in transit. By making this possible it is believed that substantial advantages will ensue to American industry and to American shipping. Many ships come to the United States in ballast it is declared which would bring cargoes for transshipment to various other countries were it not for the difficulties of our customs regulations. One of the great advantages of allowing transit privileges on foreign cargoes is the fact that on their re-assembly at American ports domestic merchandise will be mixed with the shipments of foreign origin.

Demand Action on Water Pollution Bill

Permanent Organization Formed to Push Representative Appleby's Bill Through Congress

Officials of Atlantic seaboard cities and others interested in ending the pollution of navigable waters by oil have formed a permanent organization to be known as the National Coast Anti-Pollution League. The new body elected as president Gifford Pinchot, Republican nominee for Governor of Pennsylvania, and adopted a resolution calling upon Congress to pass the bill of Congressman T. Frank Appleby of New Jersey making it a federal offense, punishable with a fine of $2,500, to dump oil on navigable waters.

Will Support Appleby Bill

At a meeting of representatives from various resorts and cities on the Atlantic coast held in Atlantic City last week this action was taken. Meetings were held on Aug. 10 and 11, at which prominent speakers emphasized the damage done by oil pollution. The feeling was unanimous that steps should be immediately taken to abate the menace. Representative Appleby said that in 1919 the total tonnage of American oil-burning vessels was 5,000,000, but that in 2 years it has increased to 19,000,000. Oil pollution has increased correspondingly, he said.

Considerable discussion centered around the question of whether the resolution should be worded to support Congressman Appleby's measure specifically. It was finally decided to pass a resolution demanding passage of the Appleby measure at the incoming session of Congress. Copies of the resolution will be forwarded to members of Congress.

Government to Consider Means

A meeting of representatives from the departments of the government concerned in the water pollution problem will shortly be held at the Department of State.

These delegates will consider the general issues involved in connection with the calling of an international conference of maritime nations, in pursuance of the joint resolution of Congress, approved July 1, 1922, with a view to the adoption of effective means for the prevention of the pollution of navigable waters by oil-burning and oil-carrying steamers.

The Department of State will be represented by Stanley K. Hornbeck; the War Department by Lieutenant-Colonel G. B. Pillsbury, Engineers Corps of the army; the Navy Department by Captain H. E. Lackey; the Interior Department by R. Van A. Mills, Bureau of Mines; the Department of Agriculture by George A. Lawyer, Chief Game Warden; the Department of Commerce by Henry O'Malley, Commissioner of Fisheries, and the Shipping Board by W. E. Griffith.

Tariff Bill Boosts Chemical Items

(Continued from page 371)

ments, in the production of synthetic resins and as accelerators in rubber vulcanizing. Aldol has promising future use in the flotation process of ore concentration, particularly copper ore.

A similar fate was suffered by an amendment to the rate on sodium nitrite, except that in this case the amendment increased the duty while the Senate subsequently reduced it. Senator Jones of Washington secured adoption of an amendment increasing the nitrite rate from 3 to 5 cents per pound, the Senate on motion of Senator Robinson reversing this decision the following day and restoring the duty of 3 cents, which was the rate as the bill came from the House.

Camphor Rates

Through an amendment offered by Senator McCormick and indorsed by Senator Smoot, the duty on camphor will be increased to 25 per cent ad valorem whenever it is made to appear to the satisfaction of the President that manufacturers in the United States are producing 2,000,000 lb. of synthetic camphor a year. The rates carried in the bill are 1 cent a lb. on crude camphor and 6 cents per lb. on refined or synthetic camphor. These specific duties are materially lower than an ad valorem duty of 25 per cent would be. The object of the amendment is to encourage the production of synthetic camphor in this country as a club over the Japanese control of the natural camphor market. During the war the Monsanto Chemical Co. of St. Louis spent about $500,000 in a plant for the manufacture of synthetic camphor, according to Senator Smoot, but this is threatened now by the Japanese competition. Whenever the total output of synthetic camphor in the United States reaches 2,000,000 lb. a year, the higher duty will go into effect to protect the industry.

Arsenic on Free List

While the bill was under consideration in the Senate, Southern Senators were successful in having arsenious acid or white arsenic stricken from the dutiable list and placed on the free list. This product is being used extensively in fighting the boll weevil and other pests of agriculture. The House imposed a rate of 8 cents per pound, the Senate Finance Committee reducing this to 2 cents and this final action makes it duty free.

Magnesium Compounds

Rates on several magnesium products were reduced by the committee. As adopted by the Senate they are: carbonate, precipiated, 1½ cents per pound; chloride, anhydrous, 1 cent per pound; chloride, not specially provided for, one-half cent per pound; sulphate or epsom salts, one-half cent per pound; oxide or calcined magnesia, medicinal, 3½ cents per pound; oxide or calcined magnesia not suitable for medicinal use, 3½ cents per pound, this last being an increase over the original rate.

Barytes

Barytes rates were reduced by the Finance Committee to the figures of the House Ways and Means Committee, which are $4 per ton on the crude ore; $7.50 per ton if ground, and 1 cent per pound on precipiated barium sulphate or blanc fixe.

Chalk

The Finance Committee increased from 20 to 30 per cent the duty on chalk or whiting or paris white, if dry, ground, bolted or precipitated. The original recommendation of the committee was for a 35 per cent duty, but this was reduced to 20 per cent when the paragraph was adopted in May, being raised to 30 per cent in the last week of Senate consideration of the bill.

Vegetable Extracts

On recommendation of the Finance Committee, the duty on vegetable extracts for dyeing and tanning—chestnut, cutch, chlorophyll, divi-divi, fustic, hemlock, logwood, mangrove, myrobalan, oak, Persian berry, quebracho, sumac, saffron, safflower, saffron cake, valonia, wattle and others not specially provided for—was reduced from 25 to 15 per cent.

Potassium Compounds

The Finance Committee increased from 1 cent to 2 cents per pound the rate on potassium chlorate and perchlorate. In the potassium paragraph of the bill the committee also struck out the proviso which imposed 15 per cent duty ad valorem duty for 5 years, in addition to the specific rates, the effect being to reduce all rates on potassium products.

Metals Schedule

As passed by the Senate, the Fordney-McCumber tariff bill provides rates in the metals schedule generally lower than those fixed in the measure as it was adopted by the House. This difference was true as the bill was reported by the Senate Finance Committee, and during the weeks of consideration the changes in metals from the committee's original figures have been downward with only a few exceptions.

In the last week of Senate consideration of the bill the Finance Committee reduced the rate on high-speed steel 7 per cent by cutting the duty on steel valued at more than 16 cents per pound to 20 per cent ad valorem, from the original figure of 25 per cent, and decreasing from 10 to 8 per cent the additional duty paid on steel containing more than six-tenths of 1 per cent of metallic alloy.

Metallic Magnesium

Rates on metallic magnesium were reduced in the final days of Senate debate on the bill on motion of Senator Phipps of Colorado, which was not resisted by the Finance Committee. As rewritten, the rate on magnesium in the crude, ingots, alloys or scrap stands in the bill at 10 cents per pound instead of 50 and 40 cents, as provided in the different classifications as originally drawn; the rate on the metal in coils, plates, sheets and other unfinished forms is 20 cents per pound instead of 40 cents, while the rate on ribbons, tubing, powder and other finished articles remains at 40 cents per pound upon the metallic magnesium content and 20 per cent ad valorem.

Aluminum

Repeated efforts were made at various stages of the bill in the Senate to reduce the duty on aluminum from the figures of 5 cents per pound on the crude and 9 cents per pound on the prepared, which were fixed by the House and unchanged by the Finance Committee, but all of these were unsuccessful. Vigorous attacks upon the Aluminum Company of America were made by the Democratic side and Senator Reed of Missouri insinuated that the influence of Secretary of the Treasury Mellon, listed as a director of this corporation, had been felt in fixing these rates. The latter charge brought a heated rejoinder from Senator McCumber, who denied that any person connected with the Treasury Department had had any connection with determining these rates and pointed out that in the first nine months of 1921 imports of unmanufactured aluminum were more than 24,000,000 lb., while exports were barely more than 1,000,000 lb.

Nickel

The Senate committee reduced from 5 to 3 cents per pound the rate on nickel. No change was made in the House rate of 1½ cents per pound on lead-bearing ore. The House rates on zinc ore, which provide a sliding scale according to the zinc content, also were unchanged, but rates on manufactures of zinc were increased slightly. The basic copper rate of 2½ cents per pound in rolls, rods or sheets was not changed.

Pig Iron

The duty on pig iron, kentledge and spiegeleisen was reduced from $1.25 per ton to 75 cents per ton during the last week of Senate consideration of the bill and scrap iron and scrap steel was reduced from $1 to 75 cents per ton.

The rates on all alloys were reduced below the figures fixed by the House Ways and Means Committee, and in its final summing up of the bill the Senate made no changes from the figures which were fixed upon these alloys in May and June.

Most of the reductions made in the metals schedule came in the manufactured articles. In the last week of consideration, the Finance Committee increased by 5 per cent the duties on woven-wire cloth of any metal, but while the figures are five points above those fixed in the House bill, the rates actually are lower as the measure stands now because of the difference in the valuation basis used by the two houses of Congress.

Treasury Department Ruling Will Stop Import of Canadian Iron Oxide

Acting under the authority of the anti-dumping clause of the emergency tariff law of May 27, 1921, which forbids the dumping of imported merchandise into the United States at prices less than the product is sold for in the country of origin, the Treasury Department has issued an order forbidding the dumping of oxide of iron. In an order published by the Treasury Department, Assistant Secretary Clifford announces that after investigation it has been found that the oxide of iron manufacturing industry in the United States is being, or is likely to be, injured by reason of the importation into the United States of oxide of iron from the Province of Quebec, and that such merchandise is sold, or is likely to be sold in the United States at less than its fair value.

The effect of this announcement is to forbid the importation of oxide of iron from the Province of Quebec, unless American purchasers arrange to pay the price which is charged for the product in Canada. Section 201 of the emergency tariff law provides that if the Secretary of the Treasury finds that articles are sold in this country cheaper than in the country of origin, the importation of the merchandise is prohibited.

Tariff Bill Prohibits Import of U. S. Trademarked Goods

In the closing days of the Senate debate on the tariff bill, the Finance Committee introduced an amendment which was adopted and incorporated in the administrative sections of the measure, making it unlawful to import into the United States any merchandise of foreign manufacture which bears a trademark registered in the Patent Office by a person residing in this country.

This provision is of especial importance to the chemical industry as its application is particularly directed to trademarks on products of patents seized by the Alien Property Custodian during the war and sold to American corporations through the Federal Trade Commission or the Chemical Foundation.

As the tariff bill was reported to the Senate by the Finance Committee, practically the same provision was contained in the paragraph on coal-tar chemicals and dyes. It was stricken out of this paragraph several days before the item was taken up in debate because of objections entered by Senator Moses of New Hampshire. Nothing more was heard of the provision until the last day fixed for consideration of Finance Committee amendments, when it was re-introduced by the committee as a section of the administrative title of the bill. Senator Moses opposed it on a point of order, debate being cut off by the time the section was reached, but he was overruled and the section was adopted.

Du Pont Dye Royalties Amounted to $72,000

Answer to Foundation Suits Announces Payments Made to Treasury During License Period

Answer has been filed by E. I. du Pont de Nemours & Co. to the two suits brought against it and the Treasurer of the United States by the Chemical Foundation for an accounting of royalties paid for the use of German dye patents. The suits involve the money paid for the use of these patents from April 10, 1919, when they were purchased by the Foundation, to Sept. 1, 1920, on which date the government license, under which the operations had been conducted by the du Pont company, was terminated.

The action is based on the Chemical Foundation's contention that all moneys paid under license for the use of the German patents from the day they were purchased should go to the Foundation and not to the United States Treasury.

The du Pont company is party to the suit only because it has already paid the money into the United States Treasury, and the action seeks mainly to discover the amount so paid. In each case the answer recites that the company obtained its license from the Federal Trade Commission, and operated under this license until the date of its termination in September, 1920. It sets forth in each case the amount of money, $61,884.98 and $10,103.88, which was paid to the Alien Property Custodian from April 1, 1919, to September, 1920. The answer also says the amount paid was a fair and reasonable royalty for all use made of the inventions.

Employment Service Offered by Four Engineering Societies

Attention is called to an employment service for engineers of every variety of training and experience which is conducted by the four national engineering societies of the United States. This service brings in touch with the various business men the service of 50,000 trained technical men who are members of these societies and one of the objects of it is to show to the various commercial houses the aid which engineers are rendering to others in the same lines and to help these firms and corporations secure similar assistance. Men of engineering training are prominent in all branches of commercial endeavor and their creative ability is recognized as being of great help in the building up of the nation's wealth.

This service is in a position to supply chemical engineers, civil engineers, mechanical engineers, electrical engineers, sales engineers, production managers, superintendents and other trained executives. It is under the direction of W. V. Brown and is located in the United Engineering Building, 29 West 39th St., New York City. Service is free to both employer and to employee.

Refractory Companies Merge

The General Refractories Co., Pittsburgh, Pa., has arranged for a bond issue of $4,000,000, the proceeds to be used in part for perfecting a merger of different refractory interests. The company will take over the General Refractories Co. of West Virginia, as well as the Standard Refractories Co., Clayburg, Pa., the latter acquisition involving $1,500,000. The Claysburg works will be operated in conjunction with the company's plant at Sproul, Pa., in this same section. The company will operate, in all, twelve plants in Pennsylvania, Kentucky and Illinois, with annual output of 247,000,000 bricks and shapes. William C. Sproul is president of the company.

Personal

J. THOMPSON BROWN has been appointed general manager of the explosives department of E. I. du Pont de Nemours & Co., Wilmington, Del., succeeding the late Charles A. Patterson.

R. H. B. ELKINS, formerly manager of the New York office of the Duriron Co., Inc., of Dayton, Ohio, has been promoted to the newly created position of chemical engineer for the same firm. Mr. Elkins will make his headquarters at the New York office and will devote his entire attention to the solution of problems for the company's customers.

Prof. GRINNELL JONES, of the chemistry department of Harvard University, has been called to Washington, where his services are to be required during the months of August and September by the United States Tariff Commission.

Dr. VICTOR K. LAMER has been appointed Cutting Traveling Fellow by Columbia University and will sail on Sept. 13 for a year's study and travel in England and on the Continent. He will investigate especially the subjects of food and physical chemistry.

GEORGE A. PROCHAZKA, of the Central Dyestuff & Color Co., is in Europe with his family on a vacation trip.

HOWARD RHODE, of the Lehigh Portland Cement Co., Allentown, Pa., gave an interesting address on the "Manufacture and Marketing of Cement," before the members of the Square Club, on Aug. 8.

Obituary

WILLIAM G. PRICE, head of William G. Price & Sons, Chester, Pa., leather manufacturers, died at his home, in Philadelphia, Aug. 7, aged 58 years. He was a member of the Manufacturers' Club and the Philadelphia Country Club, and widely known in the leather industry. He is survived by his wife, two sons and a daughter.

Market Conditions

IN CHEMICAL, METALLURGICAL AND ALLIED INDUSTRIES

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities—Prevailing Prices and Market Letters From Principal Industrial Centers

Dyes and Other Synthetic Organic Chemicals

A Brief Summary of Some of the Principal Features in the United States Tariff Commission's Recent Census of Production, Imports and Exports During 1921

AS WAS indicated in its preliminary report[1], the United States Tariff Commission's "Census of Dyes and Other Synthetic Organic Chemicals, 1921," shows an appalling decrease in production. Our output of finished dyes, 39,008,690 lb., was only 46 per cent of the 1920 production. Intermediates fell off 73 per cent in quantity. On the other hand, the total importations of coal-tar dyes during 1921 was in considerable excess of the 1920 receipts. Reducing the vat dyes to a single-strength basis, the total quantity of dyes imported in 1921 was 4,252,911 lb. and the value was $5,156,779.

Exports of domestic dyes for 1921 showed a decrease of 79 per cent as compared with the previous year. The combined value of exports of "aniline dyes" and "all other dyes" for 1921 was $6,270,155, while in 1920 it was $29,823,591 and in 1919, $15,728,499. Very significantly the commission states "this great reduction in our export trade may be attributed in part to the general business depression, but the chief cause was the appearance in the principal foreign markets, such as China, India, and Japan, of German dyes, with which the domestic producers have been unable to compete."

The Tariff Commission's census this year includes, for the first time, production statistics for all synthetic organic chemicals, whether derived from coal-tar, non-coal-tar or natural sources. Included among these are the acids, alcohols, esters, ketones, aldehydes, alkaloidal derivatives, carbocyclic compounds, etc., such as are used as perfume and flavoring ingredients, solvents, medicinals and in numerous industrial processes. The output of these materials in 1921 was 21,545,186 lb. and the sales amounted to 16,761,096 lb., valued at $13,746,235. Included in the production figure are 1,129 lb. of research chemicals, the sales of which totaled 428 lb., valued at over $18 per pound.

Dyes and Finished Products

The Tariff Commission accounts for the greatly reduced output of dyes in 1921 by (1) the loss of most of our export trade, (2) the large stocks carried over from the previous year and (3) the general business depression. In addition, reference might have been made to (*a*) the uncertainty regarding the tariff situation and (*b*) the continued inactivity of the principal textile mills resulting from the long-drawn-out labor difficulties.

The three dyes—sulphur black, indigo and agalma black 10B—accounted for 40.8 per cent of the total production of dyes in 1921. Sulphur black led with 7,832,696 lb. (20 per cent of total output); indigo was second with 6,673,968 lb. (17 per cent) and agalma black 10B followed with 1,426,194 lb. (3.7 per cent). The 1921 production when classified according to method of application on the fiber shows decreases for practically every class. Production and imports are compared graphically in Fig. 1. It will be noted that only in the case of vat dyes other

[1]See *Chem. & Met. Eng.*, vol. 27, No. 1, p. 31, July 5, 1922.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	150.92
Last week	150.37
August, 1921	158
August, 1920	264
April, 1918 (high)	286
April, 1921 (low)	140

Prices for the twenty-five commodities included in this index were practically without change during the past week. Aniline oil was advanced from 14c. to 15c. per lb., but this had only a very minor effect on the index number.

FIG. 1.—PRODUCTION AND IMPORTS OF DYES COMPARED BY CLASSES.
IMPORTS 1914 FISCAL YEAR. PRODUCTION 1917—1921. CALENDAR YEARS
IMPORTS 1920 AND 1921 CALENDAR YEARS.

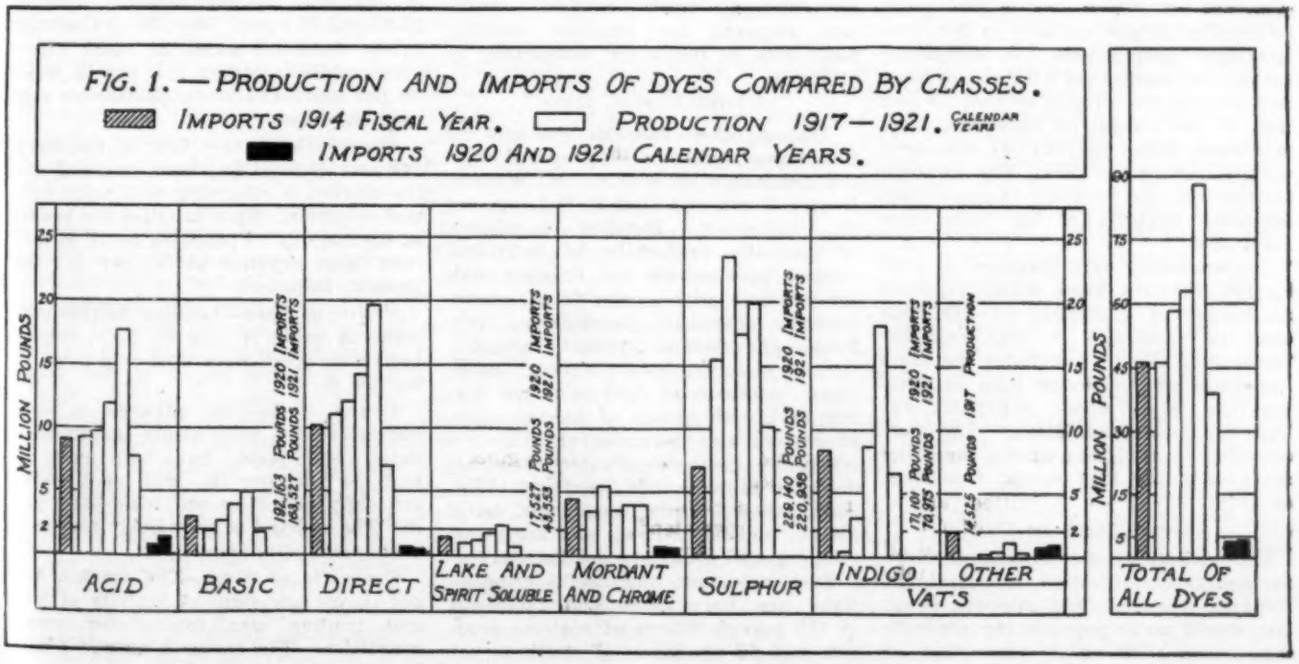
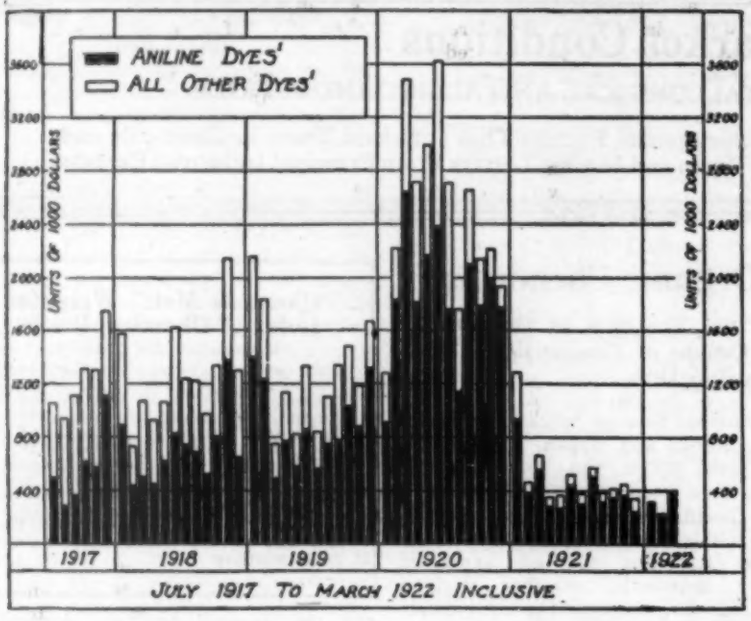


FIG. 2.—VALUE OF DOMESTIC DYES EXPORTED BY MONTHS.



than indigo is the domestic production considerably less than the 1914 imports. In commenting on this situation the report adds:

> The progress of the year included the manufacture for the first time in this country of a considerable number of colors of greater complexity and more specialized application. The development of these products is a technical achievement, highly creditable to the industry. Many of these new products were among the more important colors not heretofore manufactured in the United States and the domestic production of these products is an important step toward a self-contained industry. This progress has continued in the spring of 1922 and production of new dyes has been reported in the first 6 months of the latter year. The domestic dye industry is still somewhat deficient, however, in the manufacture of vat dyes, alizarins and certain special types.

CRUDES AND INTERMEDIATES

In the brief space at our disposal for this presentation it is possible to comment on only a few of the many interesting details included in the commission's compilations. A significant feature in connection with the production of coal-tar crudes is that 78 per cent of the output of coke was from byproduct ovens in 1921, as compared with 60 per cent in 1920. This increase assures the dye industry of more than adequate supplies of its basis raw materials.

Intermediates were produced in 1921 by 108 different firms which reported an output of 70,899,912 lb. Of this quantity 33,637,326 lb. was sold for $8,483,463. Table I includes the more important intermediates used in making the dyes which represent the bulk of our consumption. The percentages in the last column show the decrease in the 1921 output from that of 1920.

EXPORT TRADE IN DYES

Unfortunately the Commerce Department's classification of exports of domestic dyes does not give the detail that would make possible any accurate comparison with either production or imports. Their classification shows, by value only, (1) aniline dyes, (2) logwood extracts and (3) all other dyes and dyestuffs. For the first time quantity as well as value was published in 1921. The combined value of exports of aniline dyes and all other dyes for 1919 was $15,728,499 as compared with $29,823,591 for 1920. In 1921 this figure showed a sharp decline to $6,270,155. The greatest export of aniline dyes for any month of 1921 was in January, when $943,595 worth was shipped; the smallest monthly total was in December, amounting to $254,878.

TABLE I—PRODUCTION OF PRINCIPAL INTERMEDIATES

	Production in lb.	Per Cent of Decrease
Aniline oil	5,639,234	86
Benzidine	328,577	85
Gamma acid	218,717	48
H acid	1,639,323	68
Alpha-naphthylamine	429,055	92
Beta naphthol, tech.	2,959,049	75
Para-nitroaniline	832,438	61
Anthraquinone	125,358	77

OTHER USEFUL DATA

Among other valuable features of this report, which was prepared with the assistance of Warren N. Watson, Dexter North and Carl R. DeLong, are the following: Detailed tabulation of domestic production of individual crudes, intermediate and finished coal-tar products (dyes, color lakes, photographic chemicals, medicinals, perfumes and flavors, synthetic phenolic resins, and synthetic tanning materials); a census of dyes imported during 1921 with names of foreign manufacturers and countries of origin; a census of synthetic organic chemicals not of coal-tar origin (perfume chemicals, ethers, esters, medicinals, butyl alcohol and derivatives, and acetylene, ethylene and propylene derivatives.)

Two important and useful compilations are the names and addresses of 175 manufacturers of coal-tar products and 62 producers of synthetic organic chemicals.

The New York Market

NEW YORK, Aug. 21, 1922.

The acute fuel shortage and railroad difficulties were the subjects of most concern in the chemical market during the past week. There has already been a marked decrease noted in the manufacture of several important basic commodities. Producers of caustic soda and soda ash have been forced to buy coal at the present high prices and their costs of production have naturally advanced. The present situation as far as fuel is concerned is generally considered quite unfortunate, coming at the approach of the fall season, when manufacturers were preparing to open extensive campaigns for an increased volume of business.

GENERAL AND SPECIAL CHEMICALS

Barium Carbonate—Spot material held around $62@$63 per ton, with shipment figures at $61. Trading was mostly for small lot requirements.

Bicarbonate of Soda—Producers are holding the market quite steady at 1¾c. per lb., in barrels, f.o.b. works. The demand is fair.

Bichromate of Potash—Several moderate-sized sales were recorded at 10½c. per lb. Factors were not desirous of breaking away from these figures. Increased producing costs have been the underlying reason for the advance and strength in this commodity.

Bichromate of Soda—Prominent factors maintained prices at 7¾c. per lb. for round lots and 7½c. for fair-sized quantities. Some resale lots were recorded around 7¼c. per lb. The demand is quite active and has prevented any accumulation of spot stocks.

Caustic Soda—The market is in an exceedingly strong position, due to the pronounced coal shortage. Export demand at the new figures has been very difficult to meet, with only a few sales of standard brands reported sold at $3.65@$3.70 per 100 lb. Contract prices were advanced in some directions, while in others 2½c. per lb. basis 60 per cent, was being quoted for regular shipments.

Copper Sulphate—Most of the agricultural demand has been satisfied and the market is returning to a more normal situation. Spot supplies are scarce at 6½c. per lb. Producers quote 99 per cent large crystals at 6c. per lb., for prompt shipment.

Nitrite of Soda—Leading factors continue to quote 9c. per lb. f.o.b. works, but resale goods have been sold down to 8c. per lb.

Oxalic Acid—The advance in spot quotations has been firmly maintained. Sales at the works have been made as high as 16c. per lb., with spot goods generally heard around 16½@16¾c. per lb. The demand is quite lively for moderate sized quantities.

Prussiate of Soda—The market has not shown any signs of activity of late and trading was mostly for small quantities. The range is around 20½@21c. per lb.

The St. Louis Market

ST. LOUIS, MO., Aug. 17, 1922.

Conditions in the chemical market in this locality are very good, both as to general activity and favorable trend of prices. The movement during the past 2 weeks, particularly of heavy chemicals, has been quite extensive, and while a part of this increase may be attributed to the transportation situation, we believe that a greater part of it is due to the fundamental soundness of industrial conditions throughout the country, as the broadening has not been sudden, but steady from month to month since the beginning of this year.

ALKALIS

The market on alkalis continues in the same trend save for a few large orders placed in anticipation of a complete railroad tie-up. *Caustic soda*, solid, in 5- and 10-drum lots is being quoted at $3.90 and the flake at $4.25. This price has been shaded in several instances, but holds good with all reliable dealers. *Soda ash* is moving in normal volume and is being quoted at $2.20@$2.35 in 1- to 5-bag lots; on carload business as low as $1.85 per 100 lb. for 58 per cent light is being done. *Bicarbonate of soda* can be had at $2.35 in 5-bbl. lots, having advanced somewhat recently. Carload business is being done at around $1.85 per 100 lb., f.o.b. buyer's point. *Sal soda* is just now the weak member of the alkali group. Strange as it may seem, this item is affected by the miners' strike, and the wholesale grocers of St. Louis do a large volume of business throughout the mining district.

GENERAL AND SPECIAL CHEMICALS

Citric acid is very quiet, and this being the last of the season not much is to be expected in the way of heavy purchases, as consumers will buy only enough to tide them over. Stocks are plentiful and prices remain the same. Makers of *oxalic acid* are sold up, and it is very difficult to find spot goods. Quotations for immediate delivery are around 16¾c.@17c. per lb., f.o.b. producers' works, but for future delivery it is understood that this price could be shaded somewhat. Supplies of *white arsenic* are still very scarce and the market continues to be very strong, prices ranging from 7¾c.@8c., f.o.b. New York. Stocks of *blue vitriol* in this market are nil, but as the demand for insecticides is practically at an end, there should be freer movement of this article in the next few weeks. *Carbon bisulphide, technical*, remains in heavy demand, but it is not expected that this will continue for any length of time, as the season for this product is about to come to a close. *Carbon tetrachloride* is moving in a routine way. *Copperas* is still very scarce, and when buying it is not a question of price but a matter of stocks and delivery, as producers have not been able to catch up with their orders, due to the slowing up of operations of the steel mills. Prices remain unchanged. *Glycerine* has again advanced and is now being held at 16½c. The market is very firm and several large contract orders were placed at this figure recently. Another rise is not expected for the near future, but it is the consensus of the manufacturers that this price will hold for some time. *Lead acetate* is still being offered at the old schedule, however, it is rumored that an advance will take place shortly owing to the increased cost of acetic acid. *Salicylates* during the past few weeks have been moving more freely, and since our last report there has been an advance on all salicylates with the exception of *salol*, which remains unchanged. *Sulphur* is moving along at its normal rate with no change in price and no unusual business being reported. Producers of *zinc sulphate* have made a further advance in their prices, and are now quoting 3c. per lb., f.o.b. St. Louis in carlots. However, sulphate is not advancing in proportion to the increase in *spelter*, which is now being quoted at $6.20 per 100 lb., St. Louis.

VEGETABLE OILS AND NAVAL STORES

Turpentine has eased off somewhat and is being quoted today at $1.11 per gal. in 5-bbl. lots and $1.17 in single barrels. *Linseed oil* is quoted spot today at 92c. basis raw oil in 5-bbl. lots and 97c. for single barrels. This is about as previously reported. *Castor oil* has had three advances since our last report, jumping from 13¼c. to 13½@13¾c. and finally to 14c. in 400-lb. drums. This seems to be about the peak and a further rise is scarcely expected.

The Iron and Steel Market

PITTSBURGH, Aug. 18, 1922.

Steel production continues to decrease, on account of fuel conditions, and the rate of ingot production, as nearly as can be estimated, is about midway between 25,000,000 and 30,000,000 tons a year, against the rate of about 37,000,000 tons attained late in June.

The iron and steel industry derives no particular comfort from the "settlement" of the coal strike at Cleveland early in the week. The settlement itself was said to involve only about 15 per cent of the union coal capacity, and this means a smaller percentage still of the entire coal strike, for there were strikes in non-union mines, particularly in the Connellsville region, and these strikes have not been affected. Predictions are made that the Connellsville strikes will crumble within a fortnight, but these are merely predictions. The prevalent view is that among the mines formerly union the Pittsburgh district at any rate will not sign the United Mine Workers' scale but will hold out for a non-union or open shop operation, however much time may be required to attain that position.

For the nearby future at least the iron and steel industry does not expect to receive increased coal shipments and as present operations are maintained partly by stocks, now rather small, the outlook is for decreasing production of pig iron and steel.

The effect of diminishing supplies of coal is plainly observed in the production of steel, but is not apparent in the consumption of steel. It may be that consumption of steel is greatly decreased, but the evidence is not seen. Most consumers are urging mills to make heavier deliveries, and some are in the market to purchase early deliveries, which are commanding greater and greater premiums. It does not follow from the observable conditions that there are no stocks of steel in buyers' hands or that there are not large stocks in some cases, it being notorious in the steel industry that buyers endeavor to conceal their possession of steel as long as steel appears to be scarce. After every period of activity there is a spell during which consumers liquidate stocks which prove to be larger than had been assumed.

Some of the Steel Corporation subsidiaries as well as some of the independents are rationing their shipments, endeavoring to furnish steel to the more important consuming lines, while at the same time there is conservation, by denying steel to customers whose business is not of urgent character or who are unable to use the steel immediately.

ADVANCING TENDENCY IN STEEL PRICES

Steel prices show a general advancing tendency. There is not, as formerly, merely an advance in the prompt market, by the increase in delivery premiums, for basis prices, for indefinite delivery, are also advancing. An advance in the minimum on bars, shapes and plates from 1.70c. to 1.80c. was noted in last week's report. This week the American Sheet & Tin Plate Co. (Steel Corporation) has advanced its prices $2 a ton on blue annealed sheets to 2.50c. and $4 a ton on black and galvanized sheets to 3.35c. and 4.35c. respectively. The former prices had become nominal, as the company was oversold through the third quarter and had not opened books for fourth quarter. Sales are being made now chiefly to old customers. Independent pipe mills, with possibly one or two exceptions, have advanced prices on merchant pipe three points on black and two points on galvanized, a point being equivalent to about $1.90 per net ton. Some of the independent wire mills have advanced wire $2 a ton and nails 20c. a keg.

Prices for prompt delivery are not quotable, as there are various circumstances, according to the details of the individual order. An order for a tonnage of plates running into four figures has gone at 2.25c. delivery within 3 weeks.

The spot market in pig iron, the only pig iron market there is, continues to show an advancing tendency, sales being in small lots, out of stock, to urgent buyers. Foundry iron is up $2 a ton, to $30 valley, basic and bessemer being about $26 and $27 respectively, valley furnaces.

General Chemicals

Current Wholesale Prices in New York Market

		Carlots F.o.b. N.Y.	Less Carlots F.o.b. N.Y.
Acetic anhydride	lb.	..... –	$0.38 – $0.40
Acetone	lb.	$0.13½ – $0.13¾	.14 – .14½
Acid, acetic, 28 per cent	100 lbs.	2.60 – 2.65	2.70 – 3.25
Acetic, 56 per cent	100 lbs.	5.25 – 5.35	5.40 – 5.75
Acetic, glacial, 99½ per cent, carboys, 100	lbs.	12.15 – 12.25	12.30 – 13.00
Boric, crystals	lb.	.11 – .11½	.11½ – .12
Boric, powder	lb.	.11 – .11½	.11½ – .12½
Citric	lb.	..... –	.45 – .45½
Hydrochloric	100 lb.	1.10 – 1.20	1.25 – 1.70
Hydrofluoric, 52 per cent	lb.	.11 – .11½	.11 – .12
Lactic, 44 per cent tech	lb.	.09½ – .10	.10½ – .12
Lactic, 22 per cent tech	lb.	.04 – .04½	.04½ – .05
Molybdic, c.p.	lb.	3.00 – 3.25	3.30 – 3.75
Muriatic, 20 deg. (see hydrochloric)	....	..... –	..... – .....
Nitric, 40 deg	lb.	.06 – .06½	.06½ – .07
Nitric, 42 deg	lb.	.06½ – .06¾	.07 – .07½
Oxalic, crystals	lb.	.16½ – .16¾	.17 – .17½
Phosphoric, 50 per cent solution	lb.	.08 – .08½	.08½ – .09½
Picric	lb.	.20 – .22	.23 – .27
Pyrogallic, resublimed	lb.	..... –	1.65 – 1.75
Sulphuric, 60 deg., tank cars	ton	9.50 – 10.00	..... – .....
Sulphuric, 60 deg., drums	ton	12.00 – 14.00	..... – .....
Sulphuric, 66 deg., tank cars	ton	14.50 – 15.00	..... – .....
Sulphuric, 66 deg., drums	ton	19.00 – 20.00	20.50 – 21.00
Sulphuric, 66 deg., carboys	ton	..... –	..... – .....
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	19.00 – 20.00	..... – .....
Sulphuric, fuming, 20 per cent (oleum) drums	ton	22.00 – 22.50	23.00 – 24.00
Sulphuric, fuming, 20 per cent (oleum) carboys	ton	31.00 – 32.00	33.00 – 34.00
Tannic, U. S. P.	lb.	..... –	.60 – .75
Tannic (tech.)	lb.	.40 – .45	.46 – .50
Tartaric, imported crystals	lb.	..... –	.28½ – .29
Tartaric acid, imported, powdered	lb.	..... –	.29 – .30
Tartaric acid, domestic	lb.	..... –	..... – .30
Tungstic, per lb. of WO	lb.	..... –	1.00 – 1.10
Alcohol, ethyl (Cologne spirit)	gal.	..... –	4.75 – 4.95
Alcohol, methyl (see methanol)	....	..... –	..... – .....
Alcohol, denatured, 188 proof No. 1	gal.	..... –	.31 – .33
Alcohol, denatured, 188 proof No. 5	gal.	..... –	.31 – .33
Alum, ammonia, lump	lb.	.03½ – .03¾	.03¾ – .04
Alum, potash, lump	lb.	.03 – .03½	.03½ – .04
Alum, chrome lump	lb.	.05 – .05½	.05½ – .06
Aluminum sulphate, commercial	100 lb.	1.50 – 1.65	1.70 – 2.25
Aluminum sulphate, iron free	lb.	.02½ – .02¾	.03 – .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.06½ – .07¾	.07½ – .08
Ammonia, anhydrous, cyl. (100-150 lb.)	lb.	.30 – .30½	.30½ – .31
Ammonium carbonate, powder	lb.	.08½ – .08¾	.08¾ – .09
Ammonium nitrate	lb.	.06 – .06½	.06½ – .07½
Amylacetate tech	gal.	..... –	2.00 – 2.25
Arsenic, white, powdered	lb.	.08½ – .08¾	.08¾ – .09
Arsenic, red, powdered	lb.	.12 – .12½	.12½ – .13
Barium carbonate	ton	62.00 – 64.00	65.00 – 68.00
Barium chloride	ton	87.00 – 90.00	91.00 – 100.00
Barium dioxide (peroxide)	lb.	.20 – .21	.21½ – .22
Barium nitrate	lb.	.07½ – .07¾	.08 – .08½
Barium sulphate (precip.) (blanc fixe)	lb.	.04 – .04½	.04½ – .04¾
Blanc fixe, dry	lb.	.04 – .04½	..... – .....
Blanc fixe, pulp	ton	45.00 – 55.00	..... – .....
Bleaching powder	100 lb.	1.60 – 1.75	1.85 – 2.50
Blue vitriol (see copper sulphate)	.....	..... –	..... – .....
Borax	lb.	.05½ – .05¾	.06 – .06½
Brimstone (see sulphur, roll)	.....	..... –	..... – .....
Bromine	lb.	.27 – .28	.28½ – .35
Calcium acetate	100 lbs.	2.35 – 2.40	2.45 – 2.50
Calcium carbide	lb.	.04½ – .04¾	.05 – .05½
Calcium chloride, fused, lump	ton	22.00 – 23.00	23.50 – 27.00
Calcium chloride, granulated	lb.	.01½ – .01¾	.02 – .02½
Calcium peroxide	lb.	..... –	1.40 – 1.50
Calcium phosphate, tribasic	lb.	..... –	.15 – .16
Camphor	lb.	..... –	.82 – .84
Carbon bisulphide	lb.	.06 – .06½	.06½ – .07½
Carbon tetrachloride, drums	lb.	.09½ – .10	.10½ – .12
Carbonyl chloride, (phosgene)	lb.	..... –	.60 – .75
Caustic potash (see potassium hydroxide)	.....	..... –	..... – .....
Caustic soda (see sodium hydroxide)	....	..... –	..... – .....
Chalk, precip.—domestic, light	lb.	.04½ – .04¾	..... – .....
Chalk, precip.—domestic, heavy	lb.	.05½ – .05¾	..... – .....
Chalk, precip.—imported, light	lb.	.04½ – .05	..... – .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.05 – .05½	.05½ – .06
Chloroform	lb.	..... –	.25 – .32
Cobalt oxide	lb.	..... –	2.00 – 2.10
Copperas	ton	20.00 – 22.00	23.00 – 30.00
Copper carbonate, green precipitate	lb.	.19 – .20	20½ – .21
Copper cyanide	lb.	..... –	.58 – .60
Copper sulphate, crystals	100 lb.	6.50 – 6.60	6.65 – 7.00
Cream of tartar	lb.	..... –	.23 – .25
Epsom salt (see magnesium sulphate)	....	..... –	..... – .....
Ethyl acetate com. 85%	gal.	..... –	.65 – .70
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	..... –	.90 – .95
Formaldehyde, 40 per cent	lb.	.08 – .08½	.08½ – .09
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00	..... – .....
Fullers earth—imported powdered—net	ton	30.00 – 32.00	..... – .....
Fusel oil, ref	gal.	..... –	2.25 – 2.65
Fusel oil, crude	gal.	..... –	1.45 – 1.50
Glauber's salt (see sodium sulphate)	....	..... –	..... – .....
Glycerine, c. p. drums extra	lb.	..... –	.16½ – .16¾
Iodine, resublimed	lb.	..... –	4.20 – 4.25
Iron oxide, red	lb.	..... –	.12 – .18
Lead acetate, white crystals	lb.	..... –	.10½ – .11½
Lead arsenate, powd	lb.	.13 – .13½	.13½ – .14½
Lead nitrate	lb.	..... –	.15 – .20
Litharge	lb.	.07½ – .08	.08 – .09
Magnesium carbonate, technical	lb.	.06 – .06½	.06½ – .07½
Magnesium sulphate, U. S. P.	100 lb.	2.00 – 2.25	2.30 – 2.50
Magnesium sulphate, technical	100 lb.	..... –	1.00 – 1.80
Methanol, 95%	gal.	..... –	.57 – .58
Methanol, 97%	gal.	..... –	.59 – .60
Nickel salt, double	lb.	..... –	.11 – .11½
Nickel salt, single	lb.	..... –	.12 – .12½
Phosgene (see carbonyl chloride)	.....	..... –	..... – .....
Phosphorus, red	lb.	..... –	.40 – .45
Phosphorus, yellow	lb.	..... –	.30 – .35
Potassium bichromate	lb.	.10½ – .10¾	.11 – .11½
Potassium bromide, granular	lb.	..... –	.17 – .23
Potassium carbonate, U. S. P.	lb.	.12 – .12½	.13 – .16
Potassium carbonate, 80–85%	lb.	.05 – .05½	.05½ – .06
Potassium chlorate, powdered and crystals	lb.	.06½ – .07	.07½ – .08
Potassium cyanide	lb.	..... –	.55 – .57
Potassium hydroxide (caustic potash)	100 lb.	5.50 – 5.75	6.00 – 6.25
Potassium iodide	lb.	..... –	3.20 – 3.35
Potassium nitrate	lb.	.06½ – .06¾	.07 – .08
Potassium permanganate	lb.	.13 – .13½	.14 – .15
Potassium prussiate, red	lb.	..... –	.90 – .95
Potassium prussiate, yellow	lb.	.32½ – .32¾	.33 – .33½
Rochelle salts (see sodium potas. tartrate)	....	..... –	..... – .....
Salammoniac, white, granular	lb.	.06½ – .06¾	.06½ – .07
Salammoniac, gray, granular	lb.	.07½ – .08	.08½ – .08¾
Salsoda	100 lb.	1.20 – 1.40	1.45 – 1.60
Salt cake (bulk)	ton	18.00 – 21.00	..... – .....
Soda ash, light, 58 per cent flat, bags, contract	100 lb.	1.60 – 1.67	2.00 – 2.25
Soda ash, light, 58 per cent flat, bags, resale	100 lb.	1.75 – 1.80	1.85 – 2.35
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90	1.95 – 2.40
Sodium acetate	lb.	.06½ – .06¾	.07 – .07½
Sodium bicarbonate	100 lb.	1.75 – 1.85	1.90 – 2.30
Sodium bichromate	lb.	.07½ – .07¾	.08 – .08½
Sodium bisulphate (nitre cake)	ton	4.50 – 4.60	4.65 – 5.50
Sodium bisulphite powdered, U.S.P.	lb.	.04½ – .04¾	.04¾ – .05½
Sodium chlorate	lb.	.06½ – .06¾	.07 – .07½
Sodium chloride	long ton	12.00 – 13.00	..... – .....
Sodium cyanide	lb.	.19½ – .21	.21½ – .25
Sodium fluoride	lb.	.09½ – .10	.10½ – .10¾
Sodium hydroxide (caustic soda) solid, 76 per cent flat, drums, contract	100 lb.	3.35 – 3.40	3.75 – 4.00
Sodium hydroxide (caustic soda) solid, 76% flat, drums, resale	100 lb.	3.70 – 3.75	3.80 – 4.00
Sodium hydroxide (caustic soda), ground and flake, contracts	100 lb.	3.80 – 3.90	4.25 – 4.40
Sodium hydroxide (caustic soda) ground and flake, resale	100 lb.	4.00 – 4.15	4.40 – 4.60
Sodium hyposulphite	lb.	.02½ – .03	.03½ – .03¾
Sodium nitrite	lb.	.08 – .08½	.08½ – .09
Sodium peroxide, powdered	lb.	.28 – .30	.31 – .35
Sodium phosphate, dibasic	lb.	.03½ – .04	.04½ – .04¾
Sodium potassium tartrate (Rochelle salts)	lb.	..... –	.18 – .21
Sodium prussiate, yellow	lb.	.20½ – .21	.21½ – .21¾
Sodium silicate, (40 deg. in drums)	100 lb.	.80 – 1.00	1.05 – 1.25
Sodium silicate, (60 deg. in drums)	100 lb.	2.25 – 2.40	2.45 – 2.75
Sodium sulphate, crystals (glaubers salt)	100 lbs.	.90 – 1.00	1.05 – 1.50
Sodium sulphide, fused, 60-62 per cent (cone.)	lb.	.04 – .04½	.04½ – .05
Sodium sulphite, crystals	lb.	.03¼ – .03½	.03½ – .04½
Strontium nitrate, powdered	lb.	.09½ – .10	.10½ – .12
Sulphur chloride, yellow	lb.	.04½ – .05	.05½ – .06
Sulphur, crude	ton	18.00 – 20.00	..... – .....
Sulphur dioxide, liquid, cylinders extra	lb.	.08 – .08½	.09 – .10
Sulphur (sublimed), flour	100 lb.	..... –	2.25 – 3.10
Sulphur, roll (brimstone)	100 lb.	2.00 – 2.15	2.20 – 2.70
Talc—imported	ton	30.00 – 40.00	..... – .....
Talc—domestic powdered	ton	18.00 – 25.00	..... – .....
Tin bichloride	lb.	.09 – .09½	.09½ – .10
Tin oxide	lb.	..... –	.35 – .37
Zinc carbonate	lb.	.14 – .14½	.14½ – .15½
Zinc chloride, gran	lb.	.5½ – .06	.06½ – .06¾
Zinc cyanide	lb.	.42 – .44	.45 – .47
Zinc oxide, XX	lb.	.07½ – .08	.08½ – .08¾
Zinc sulphate	100 lb.	2.75 – 3.00	3.05 – 3.30

Coal-Tar Products

NOTE—These prices are for original packages in large quantities f.o.b. N.Y.:

Alpha-naphthol, crude	lb.	$1.00 — $1.05
Alpha-naphthol, refined	lb.	1.10 — 1.15
Alpha-naphthylamine	lb.	.28 — .30
Aniline oil, drums extra	lb.	.15 — .17
Aniline salts	lb.	.22 — .24
Anthracene, 80% in drums (100 lb.)	lb.	.75 — 1.00
Benzaldehyde U.S.P.	lb.	1.30 — 1.35
Benzene, pure, water-white, in drums (100 gal.)	gal.	.30 — .35
Benzene, 90%, in drums (100 gal.)	gal.	.28 — .32
Benzidine, base	lb.	.85 — .95
Benzidine sulphate	lb	.80 — .85
Benzoic acid, U.S.P.	lb.	.65 — .67
Benzoate of soda, U.S.P.	lb.	.53 — .55
Benzyl chloride, 95-97%, refined	lb.	.25 — .27
Benzyl chloride, tech	lb.	.20 — .23
Beta-naphthol benzoate	lb.	3.75 — 4.00
Beta-naphthol, sublimed	lb.	.50 — .55
Beta-naphthol, tech	lb.	.22 — .25
Beta-naphthyla mine, sublimed	lb.	1.50 — 1.60
Carbazol	lb.	.75 — .90
Cresol, U. S. P., in drums (100 lb.)	lb.	.12 — .15
Ortho-oresol, in drums (100 lb.)	lb.	.16 — .18
Cresylic acid, 97–99%, straw color, in drums	gal.	.56 — .65
Cresylic acid, 95-97%, dark, in drums	gal.	.51 — .58
Dichlorbenzene	lb.	.06 — .09
Diethylaniline	lb.	.65 — .70
Dimethylaniline	lb.	.33 — .35
Dinitrobenzene	lb.	.20 — .22
Dinitroclorbenzene	lb.	.21 — .22
Dinitronaphthalene	lb.	.30 — .32
Dinitrophenol	lb.	.33 — .35
Dinitrotoluene	lb.	.22 — .24
Dip oil, 25%, car lots, in drums	gal.	.24 — .26
Diphenylamine	lb.	.54 — .56
H-acid	lb.	.80 — .85
Meta-phenylenediamine	lb.	.85 — 1.00
Monochlorbenzene	lb.	.10 — .11
Monoethylaniline	lb.	1.00 — 1.20
Naphthalene crushed, in bbls.	lb.	.06 — .06½
Naphthalene, flake	lb.	.06½ — .07
Naphthalene, balls	lb.	.07½ — .08
Naphthionate of soda	lb.	.58 — .65
Naphthionic acid, crude	lb.	.65 — .70
Nitrobenzene	lb.	.10 — .12
Nitro-naphthalene	lb.	.30 — .35

Nitro-toluene	lb.	$0.15 —	$0.17
N-W acid	lb.	1.15 —	1.30
Ortho-amidophenol	lb.	2.10 —	2.15
Ortho-dichlor-benzene	lb.	.17 —	.20
Ortho-nitro-phenol	lb.	.75 —	.77
Ortho-nitro-toluene	lb.	.10 —	.13
Ortho-toluidine	lb.	.12 —	.14
Para-amidophenol, base	lb.	1.25 —	1.30
Para-amidophenol, HCl	lb.	1.30 —	1.35
Para-dichlorbenzene	lb.	.17 —	.20
Paranitroaniline	lb.	.72 —	.80
Para-nitrotoluene	lb.	.55 —	.65
Para-phenylenediamine	lb.	1.55 —	1.60
Para-toluidine	lb.	.85 —	.90
Phthalic anhydride	lb.	.35 —	.38
Phenol, U. S. P., drums	lb.	.16 —	.18
Pyridine	gal.	1.75 —	2.75
Resorcinol, technical	lb.	1.30 —	1.35
Resorcinol, pure	lb.	1.75 —	1.80
R-salt	lb.	.55 —	.60
Salicylic acid, tech., in bbls	lb.	.24 —	.26
Salicylic acid, U. S. P	lb.	.28 —	.29
Solvent naphtha, water-white, in drums, 100 gal	gal.	.27 —	.32
Solvent naphtha, crude, heavy, in drums, 100 gal	gal.	.14 —	.18
Sulphanilic acid, crude	lb.	.24 —	.26
Tolidine	lb.	1.20 —	1.30
Toluidine, mixed	lb.	.30 —	.35
Toluene, in tank cars	gal.	.25 —	.28
Toluene, in drums	gal.	.30 —	.35
Xylidines, drums, 100 gal	lb.	.40 —	.45
Xylene, pure, in drums	gal.	.40 —	.45
Xylene, pure, in tank cars	gal.	.45 —	....
Xylene, commercial, in drums, 100 gal	gal.	.33 —	.35
Xylene, commercial, in tank cars	gal.	.30 —	....

Waxes

Prices based on original packages in large quantities f.o.b. N.Y.

Bayberry Wax	lb.	$0.20 —	$0.21
Beeswax, refined, dark	lb.	.30 —	.32
Beeswax, refined, light	lb.	.34 —	.35
Beeswax, pure white	lb.	.38 —	.42
Candellila, wax	lb.	.38 —	.40
Carnauba, No. 1	lb.	.40 —	.42
Carnauba No. 2, North Country	lb.	.24 —	.25
Carnauba, No. 3, North Country	lb.	.17 —	.17½
Japan	lb.	.16 —	.16½
Montan, crude	lb.	.03½—	.04
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.04½—	....
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.02½—	....
Paraffine waxes, refined, 118-120 m.p.	lb.	.03½—	.03½
Paraffine waxes, refined, 125 m.p.	lb.	.03½—	.03½
Paraffine waxes, refined, 128-130 m.p.	lb.	.04 —	.04½
Paraffine waxes, refined, 133-135 m.p.	lb.	.04½—	.04½
Paraffine waxes, refined, 135-137 m.p.	lb.	.05 —	.05½
Stearic acid, single pressed	lb.	.09 —	.09½
Stearic acid, double pressed	lb.	.09½—	.09½
Stearic acid, triple pressed	lb.	.10½—	.10½

Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl.	280 lb.	$6.35 —	$6.40
Rosin E-I	280 lb.	6.45 —	6.85
Rosin K-N	280 lb.	6.90 —	8.10
Rosin W. G.-W. W	280 lb.	7.85 —	8.40
Wood rosin, bbl.	280 lb.	6.25 —	....
Spirits of turpentine	gal.	1.25 —	1.26
Wood turpentine, steam dist	gal.	.85 —	....
Wood turpentine, dest. dist.	gal.	.70 —	.70
Pine tar pitch, bbl.	200 lb.	..... —	6.00
Tar, kiln burned, bbl. (500 lb.)	bbl.	..... —	9.50
Retort tar, bbl.	500 lb.	—	9.00
Rosin oil, first run	gal.	.36 —	....
Rosin oil, second run	gal.	.38 —	....
Rosin oil, third run	gal.	.46 —	....
Pine oil, steam dist., sp.gr., 0.930-0.940	gal.		1.00
Pine oil, pure, dest. dist	gal.		.95
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.		.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal.		.35
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.		.75
Pine tar, ref., thin, sp.gr., 1.080-1.960	gal.		.25
Hardwood oil, f.o.b. Mich., sp.gr., 0.960-0.990	gal.		.25
Pinewood creosote, ref	gal.		.52

Fertilizers

Ammonium sulphate, f.a.s., N. Y., double bags	100 lb.	3.55 —	3.60
Blood, dried, f.o.b., N. Y	unit	4.75 —	....
Bone, 3 and 50, ground, raw	ton	37.00 —	39.00
Fish scrap, dom., dried, f.o.b. works	unit	3.10 —	3.20
Nitrate of soda	100 lb.	2.50 —	2.55
Tankage, high grade, f.o.b. Chicago	unit	4.50 —	4.60
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	3.50 —	4.00
Tennessee, 78-80%	ton	7.00 —	8.00
Potassium muriate, 80%	ton	33.00 —	34.00
Potassium sulphate	unit	1.00 —	....

Crude Rubber

Para—Upriver fine	lb.	$0.19 —	.20
Upriver coarse	lb.	.13½—	.13½
Upriver caucho ball	lb.	.13½—	.13½
Plantation—First latex crepe	lb.	.14 —	.14½
Ribbed smoked sheets	lb.	.14 —	.14½
Brown crepe, thin, clean	lb.	.13½—	....
Amber crepe No. 1	lb.	.14 —	....

Oils

VEGETABLE

The following prices are f.o.b. New York for carload lots.

Castor oil, No. 3, in bbls	lb.	$0.12½ —	$0.13
Castor oil, AA, in bbls	lb.	.13 —	.13½
China wood oil, in bbls	lb.	.12½ —	.12½
Cocoanut oil, Ceylon grade, in bbls	lb.	.08½ —	.08½
Cocoanut oil, Cochin grade, in bbls	lb.	.09 —	.09½
Corn oil, crude, in bbls	lb.	.10½ —	.10½
Cottonseed oil, crude (f. o. b. mill)	lb.	.08 —	.08½
Cottonseed oil, summer yellow	lb.	.10½ —	.11
Cottonseed oil, winter yellow	lb.	.11½ —	.12
Linseed oil, raw, car lots (domestic)	gal.	.88 —	.89
Linseed oil, raw, tank cars (domestic)	gal.	.84 —	.85
Linseed oil, boiled, in 5-bbl lots (domestic)	gal.	.90 —	.91
Olive oil, denatured	gal.	1.15 —	1.17
Palm, Lagos	lb.	.07 —	.07½
Palm, Niger	lb.	.06½ —	.06½
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.09½ —	.09½
Peanut oil, refined, in bbls	lb.	.12 —	.12½
Rapeseed oil, refined in bbls	gal.	.82 —	.83
Rapeseed oil, blown, in bbls	gal.	.88 —	.89
Soya bean oil (Manchurian), in bbls. N. Y	lb.	.11½ —	....
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.09½ —	....

FISH

Light pressed menhaden	gal.	$0.53 —	....
Yellow bleached menhaden	gal.	.54 —	.55
White bleached menhaden	gal.	.56 —	.57
Blown menhaden	gal.	.61 —	....
Whale Oil, No. 1, crude, tanks, coast	gal.	.45 —	.48

Miscellaneous Materials

All prices remain quotably unchanged.

Ferro-Alloys

Quotations same as previous report.

Ores and Semi-finished Products

All f.o.b. New York Unless Otherwise Stated

Bauxite, domestic, crushed and dried, f.o.b. works	net ton	$6.00 —	$9.00
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	19.00 —	21.00
Chrome ore, 50% Cr_2O_3, f.o.b. Atlantic seaboard	ton	18.00 —	21.00
Coke, foundry, f.o.b. ovens	net ton	14.50 —	.....
Coke, furnace, f.o.b. ovens	net ton	14.00 —	.....
Fluorspar, gravel, f.o.b. mines, New Mexico	net ton	15.00 —	.....
Fluorspar, standard, domestic washed gravel Kentucky and Illinois mines	net ton	17.50 —	19.00
Ilmenite, 52% TiO_2, per lb. ore	lb.	.01½—	.01½
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.29 —	....
Manganese ore, chemical (MnO_2)	net ton	60.00 —	65.00
Molybdenite, 85% MoS_2, per lb. of MoS_2, N. Y.	lb.	.45 —	.50
Monazite, per unit of ThO_2, c.i.f., Atlantic seaport	unit	27.00 —	.....
Pyrites, Spanish, fines, c.i.f., Atlantic seaport	unit	.10½—	.11
Pyrites, Spanish, furnace size, c.i.f. Atlantic seaport	unit	.12 —	.13½
Pyrites, domestic, fines, f.o.b. mines, Ga	unit	Nominal	
Rutile, 95% TiO_2 per lb. ore	lb.	.12 —	.....
Tungsten, scheelite, 60% WO_3 and over, per unit of WO_3 (nominal)	unit	3.00 —	3.25
Tungsten, wolframite, 60% WO_3 and over, per unit of WO_3, N. Y. C	unit	3.25 —	3.50
Uranium ore (carnotite) per lb. of U_3O_8	lb.	1.25 —	1.75
Uranium oxide, 96% per lb. contained U_3O_8	lb.	2.25 —	2.50
Vanadium pentoxide, 99%	lb.	12.00 —	14.00
Vanadium ore, per lb. of V_2O_5 contained	lb.	1.00 —	.....
Zircon, washed, iron free, f.o.b. Pablo, Florida	lb.	.04½—	.13½

Non-Ferrous Metals

All f.o.b. New York Unless Otherwise Stated

	Cents per Lb.
Copper, electrolytic	14.00
Aluminum, 98 to 99 per cent	19.10
Antimony, wholesale lots, Chinese and Japanese	5.25
Nickel, ordinary (ingot)	36.00
Nickel, electrolytic	39.00
Nickel, electrolytic, resale	32.00–33.00
Nickel, ingot and shot, resale	30.00–31.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	35.00
Monel metal, sheet bars	38.00
Tin, 5-ton lots, Straits	32.75
Lead, New York, spot	5.75–5.80
Lead, E. St. Louis, spot	5.525
Zinc, spot, New York	6.55
Zinc, spot, E. St. Louis	6.15

OTHER METALS

Silver (commercial)	oz.	$0.69½
Cadmium	lb.	1.20–1.25
Bismuth (500 lb. lots)	lb.	2.00@2.10
Cobalt	lb.	3.00@3.25
Magnesium, ingots, 99 per cent	lb.	1.15@1.25
Platinum	oz.	93.00
Iridium	oz.	180.00@185.00
Palladium	oz.	55.00
Mercury	75 lb.	57.00

Industrial

Financial, Construction and Manufacturers' News

Industrial Developments

GLASS—The Hart Glass Co., Dunkirk, Ind., has resumed operations at its plant, following a short curtailment due primarily to fuel shortage. It is planned to operate at full capacity with regular working force.

Owing to inability to obtain raw materials on account of the railroad strike, the B. R. C. Bottle Works, Cedar Grove, near Shreveport, La., has closed down until the situation shows improvement.

The Upland Flint Glass Co., Upland, near Hartford City, Ind., is developing maximum output at its plant and expects to run on a capacity basis at an early date. New shops are being added and additions will be made in the working force.

LEATHER—The C. P. Osborne Co., Peabody, Mass., is running practically at full capacity at its local tanning plant, with a daily schedule of production calling for about 150 doz. sheepskins, 250 splits and 300 sides of case leather. A regular working force is being employed. The plant is said to have orders on hand to insure this basis of operation for at least 3 months to come.

Glazed kid plants at Wilmington, Del., are gradually increasing production and on the general average are now working close to three-quarters of normal capacity. One local plant is running at maximum output, with full working force.

RUBBER—The Firestone Tire & Rubber Co., Akron, O., is arranging for the early operation of its new plant at Hamilton, Ont., now nearing completion, and will run on a basis of about 1,500 tires per day for a number of weeks. This output will be increased closely following thereafter.

The B. F. Goodrich Co., Akron, O., is pushing production at its local plant, and expects to exceed the current daily output of 20,000 tires, recently established, at an early date.

The Kelly-Springfield Tire Co., Akron, and Wooster, O., is maintaining operations at its local mills on a capacity basis with full working force. It is expected to continue on this schedule for an indefinite period.

Following a reduction in the price of tires the Miller Tire & Rubber Co., Akron, O., is said to have received a quantity of heavy orders necessitating an increase in the current production of 7,500 tires per day, recently established. The advance will be made at an early date, with increased working force.

IRON AND STEEL—The Brier Hill Steel Co., Youngstown, O., has resumed operations at its plate mill, known as Mill No. 132, giving employment to about 150 men, following a curtailment for the last 60 days.

The American Sheet & Tin Plate Co., Elwood, Ind., has resumed operations at all of its local hot mills, forced to shut down recently on account of fuel shortage. It is expected to maintain continuous operations for an indefinite period.

The Gulf States Steel Co., Gadsden, Ala., is running full at its local finishing mills. Four open-hearth furnaces are now in service at the plant.

Owing to fuel shortage, the Phœnix Iron Co., Phœnixville, Pa., has been compelled to shut down its local furnaces, affecting about 150 employees. It is expected to resume as soon as possible.

The Inland Steel Co., Chicago Heights, Ind., has curtailed operations at its hard steel bar mill owing to a strike of employees, who have asked a wage advance of 20 per cent. A portion of the plant of the Calumet Steel Co., in the same district, has also been closed on the same account. About 900 men are out at the present time.

The Wheeling Steel & Iron Co., Benwood, W. Va., has closed down its local mills, following operations for a number of weeks on an 80 per cent capacity basis. It is said that the curtailment is due to the railroad and coal strikes. About 250 men are affected.

As a result of the railroad and coal strikes, the United States Steel Corp. has reduced operations at its mills in the Chicago, Ill., district from 84 to 78 per cent of capacity. The corporation is concentrating on blast furnace operations at its plants in the Youngstown, O., district in order to furnish material to the rolling mills of the American Sheet & Tin Plate Co. Its subsidiary, the Carnegie Steel Co., is maintaining production at ten blast furnaces in the Youngstown section.

The Glasgow Iron Co., Pottstown, Pa., has resumed operations at all departments at its local mills on a capacity basis, giving employment to a regular working quota. Continuous operation is assured for a long period due to large reserve coal supply.

The Janson Iron & Steel Co., Columbia, Pa., has closed down its local mills owing to fuel shortage. The Columbia Rolling Mill of the Reading Iron Co., at this place, is continuing production and has sufficient fuel to run for a few weeks.

The Weatherly Iron & Steel Co., Weatherly, Pa., is operating on a full-capacity basis, and has more orders on hand than for several years past. The plant is shipping on an average of 10 carloads of finished products per week.

The Colorado Fuel & Iron Co., Pueblo, Colo., is curtailing operations at its mills, and about 1,500 men have been released recently. The plant is now giving employment to more than 4,500 operatives.

The Republic Iron & Steel Co., Youngstown, O., is arranging for the use of fuel oil in its open-hearth department, instead of coal, and will fire a number of units at an early date.

The Carnegie Steel Co. has banked all departments at its Farrell Works, Sharon, Pa., with the exception of one blast furnace, affecting about 1,200 men.

MISCELLANEOUS—The Kinzer Brick Co., Ephrata, Pa., has adopted a capacity basis of production at its local plant, giving employment to a full working force.

The Norton Co., Worcester, Mass., manufacturer of abrasive products, is resuming operations at its branch plants at Niagara Falls, N. Y., and Chippawa, Ont., following an extended shut down. Each plant will give employment to about 200 men for initial operations.

Foundries at Sandusky, O., are now running at close to normal production, giving employment to regular working forces.

Owing to fuel shortage, the American Zinc Products Co., Greencastle, Ind., has closed a number of departments at its local mills.

Construction and Operation

Alabama

KEYSTONE—The Keystone Lime Works, Inc., recently organized, has obtained a local plant building and will soon begin the installation of hydrating and operating machinery for a daily capacity of about 1,000 bbl. of lime. The equipment for the most part will be electrically operated. W. A. Hammond, Saginaw, Ala., and George L. Scott, Longview, Ala., head the company.

GADSDEN—The Tri-City Gas Co. will begin at once the installation of a new gas producer and auxiliary machinery at its local plant.

California

TURLOCK — The Hunt-Jewett-Bontz Co., South 1st St., has completed plans and will soon break ground for the construction of a new local plant for the manufacture of industrial alcohol and kindred products. It will consist of a main 4-story factory, with 1-story structure adjoining, estimated to cost about $175,000. The machinery installation will cost in excess of $225,000 in addition to the amount noted.

SAN FRANCISCO—The Illinois Glass Co., San Francisco, manufacturer of hollow ware, bottles, etc., has leased a 2-story building, 124x200 ft., on Mariposa St., near Alabama St., for which plans are now being prepared. It is estimated to cost $125,000. It is planned to have the structure ready for occupancy at an early date.

Connecticut

DANBURY — The Metropolitan Concrete Block Co. has plans under way for the establishment of a new plant for the manufacture of brick, to be operated in conjunction with a recently established works for the production of concrete blocks. A number of kilns will be constructed and machinery installed for a large output. Charles Woods is in charge.

HARTFORD—The Skat Co., Francis Ave., manufacturer of soaps, soap powders, etc., has awarded a contract to Wise & Upson, Inc., for the construction of its proposed 1-story plant addition, 46x61 ft. Work will be commenced at once. F. C. Walz, Hartford, is architect.

WALLINGFORD—The Wallingford Steel Co., recently organized with a capital of $200,000, is arranging for the early occupancy of its new local plant, now in course of completion. Initial production will be devoted to cold-rolled steel products. The new works is said to represent an investment of approximately $75,000, and will be extended at a later date.

MANCHESTER—The Oxford Soap Co., Hilliard St., has awarded a contract to the H. P. Cummings Construction Co., Ware, Mass., for the construction of a new 2- and 3-story plant addition, 70x150 ft., to be used for general manufacture.

MILFORD—The Hoyt Silver Co., New York, N. Y., recently organized by William T. Hoyt, 9 Maiden Lane, and now operating a small plant at 338 Pearl St., is planning for the early establishment of a new plant at Milford for the manufacture of a special stainless metal. The initial works will give employment to close to 300 persons.

Florida

LAKE WORTH—F. E. Bryant, Lake Worth, is organizing a company to construct and operate a sugar-refining plant. A tract of 11,000 acres of land has been acquired in Palm Beach County, to be used for the plant's site, and for sugar cane plantations. It is planned to commence operations at an early date.

Indiana

INDIANAPOLIS — The Board of Sanitary Commissioners, City Hall, E. B. Swift, president, has plans under way and will call for bids at an early date for the construction of a new purification plant at the city water works, 1-story, 100x140 ft., estimated to cost $530,000, including equipment. Charles H. Hurd, 1405 Merchants Bank Bldg., is engineer.

INDIANAPOLIS—The Beveridge Paper Co., Pearl St., has filed plans for the construction of a new plant addition, adjoining its present works, estimated to cost close to $50,000. H. L. Beveridge is president.

HAMMOND—The Metals Refining Co., 627 Hohman St., has awarded a contract to Rowley Bros. Co., 332 South LaSalle St., Chicago, Ill., for the construction of a new 1-story and basement building on Summer St., 38x50 ft., estimated to cost about $35,000.

INDIANAPOLIS—The Chapman-Price Steel Co., Shelby St., will hold in temporary abeyance the construction of its proposed new local steel mill, comprising a number of buildings, estimated to cost about $500,000, with equipment. It is expected to commence erection some time during the coming year. Niles Chapman is president.

KOKOMO—The Mileage Oil Refining Co., comprising a recently consolidation of the Service Oil & Refining Co., the Hoosier Oil Co. and the Iroquois Oil Co., is planning for the early operation of its oil refinery at Fairmount, Ind., and will develop a capacity of 1,200 bbl. per day. The company has arranged for an increase in capital from $100,000 to $800,000, and will use a portion of the proceeds, it is said, for extensions and improvements in the plant, including the construction of a number of service buildings. J. C. F. Martin is president and S. W. Winder, Marion, Ind., is secretary and treasurer.

Illinois

CHICAGO — The International Harvester Co., 606 South Michigan Ave., will commence the immediate construction of a 1-story, open-hearth furnace building at its Wisconsin steel works, Torence Ave. near 110th St., to be 143x500 ft., estimated to cost $360,000. The general contract has been let to the Bates & Rogers Construction Co., 37 West Van Buren St.

Louisiana

SHREVEPORT—The Southern Soap Co., Box 602, recently organized with a capital of $100,000, has plans under way for the con-

struction of a local plant for the manufacture of soaps, soap powders and kindred specialties. Work will be commenced at an early date. A list of equipment to be installed will be arranged at once, and bids called early in September. W. A. Vickers is president and general manager.

WINNFIELD—A. C. Campbell, Winnfield, is organizing a company to construct and operate a local plant for the manufacture of concrete blocks, tile and kindred productions. It is proposed to commence work at an early date.

Maine

BRIDGTON—Fire, Aug. 6 damaged a portion of the plant of the Sims Leather Co., with loss estimated at close to $13,000.

Maryland

BALTIMORE — The Bethlehem Steel Corp., Bethlehem, Pa., will commence the immediate construction of an addition to its local plant in the Sparrows Point district, estimated to cost in excess of $3,000,000, with equipment. The work will comprise a number of new open-hearth units with subsidiary departments, to provide for an increase of close to 5000,000 tons of steel ingots per annum. Eugene G. Grace is president.

Michigan

MONROE—The Republic Glass Co., Kentucky Ave., will commence the immediate construction of a new 1-story plant, 200x400 ft., for the manufacture of general glass products, estimated to cost about $50,006, exclusive of equipment. Emanuel Llera is president.

Minnesota

ST. PAUL—The Flaxlinum Insulating Co., Hampden and Wabash Aves., manufacturer of insulating products, plans for the rebuilding of the portion of its works recently destroyed by fire.

Missouri

ELDORADO SPRINGS—The Eldorado Development Co., recently organized with a capital of $300,000, has acquired a tract of about 320 acres of land, and plans for the establishment of a new zinc plant. It is proposed to provide a capacity of approximately 300 tons per day. A list of equipment for installation is being arranged, and it is expected to call for bids during September. A. B. Stricklett is president and general manager.

North Carolina

PINE HALL—The Pine Hall Brick Co., recently organized, has acquired the plant and property of the Dan River Brick Co., comprising about 125 acres of land, and will inaugurate operations at an early date. Plans are said to be under way for extensions and improvements. C. L. Lester is general manager.

CHARLOTTE—The City Council is taking bids until Aug. 29 for the construction of a new filtration plant at the municipal water works, estimated to cost about $300,000. William Platt, Durham, N. C., is consulting engineer. Edgar Reade is city clerk.

COLON—The L. C. Isenhour Co. has preliminary plans under consideration for the construction of a local plant for the manufacture of brick, tile and kindred burned clay products.

RALEIGH—The City Council has plans in preparation for the construction of a new filter plant at the city waterworks, to include an electrically operated pumping station, estimated to cost about $150,000. Bids will be asked in September. J. B. Bray, chairman of the Board of Public Works, is in charge. William C. Olsen, Kinston, N. C., is consulting engineer.

New Jersey

LINDEN—The Superior Novelty Mfg. Co., 124 East Jersey St., Elizabeth, N. J., manufacturer of celluloid and fiber products, has awarded a contract to H. Wilhelms & Sons, Inc., Elizabeth, for the construction of a new 1-story plant, 50x200 ft., on Edgar Road, Linden, to cost approximately $50,000. William Finne, 712 1st Ave., Elizabeth, is architect.

New York

LONG ISLAND CITY—The National Liquid Bleach Co., 18 Purvis St., has acquired an entire block front of property on Foster Ave. between Honeywell and Buckley Sts., as a site for a new plant. Plans will be prepared at once and construction commenced at an early date.

NEW YORK—The Tidal Refining Co., 11 Broadway, a subsidiary of the Tidewater Oil Co., with headquarters at the same address, has appropriated a fund of $1,000,000 for extensions and improvements in its oil refineries and gasoline extraction plants in Oklahoma and Kansas. The company is now operating 2 oil refineries and 22 gasoline plants. Considerable new equipment will be installed.

NEW YORK—Fire, Aug. 8, destroyed a portion of the plant of W. H. Dong & Co., 244 Canal St., manufacturers of coloring products for foodstuffs, etc., with loss approximating $12,000. It is proposed to replace the damage at an early date.

Ohio

TOLEDO—The Toledo-Libbey-Owens Sheet Glass Co., a subsidiary of the Libbey-Owens Sheet Glass Co., Nicholas Bldg., has completed plans and will break ground at once for the construction of a new local plant for the manufacture of sheet glass products. The initial works will comprise a number of buildings, with tanks, electric power plant, etc., and are estimated to cost close to $3,000,000, including equipment. The company is capitalized at $6,000,000, and has arranged for the sale of a preferred stock issue of $3,000,000 to finance the construction.

MIDDLETOWN—The Gardner-Harvey Paper Co. will soon take bids for the construction of a new 1-story and basement plant addition, 200x400 ft., estimated to cost approximately $130,000. E. T. Gardner is president.

Oklahoma

ARDMORE—The Amerada Petroleum Corp. has acquired property in the Amerada Pool district as a site for the construction of a new absorption gasoline plant, to have a capacity of 4,500,000 cu.ft. Plans will be prepared at an early date.

Pennsylvania

GREENVILLE—The Greenville Steel & Iron Co., care of the Greenville Chamber of Commerce, has plans in progress for the construction of a new plant on local site for the manufacture of steel products. It will comprise a number of buildings including four 60-ton open-hearth furnaces, and one 10-ton open-hearth furnace, the latter to be used in connection with experimental work; blast furnace; four rolling mills; cold drawing mill, etc. A 15,000-hp. power plant will also be built. A feature will be made of the manufacture of electric steel castings. The plant will have an initial output of close to 300,000 tons a year, and is estimated to cost approximately $2,000,000. General offices will be located at Greenville. Colonel H. P. Bope, formerly connected with the Carnegie Steel Co., Pittsburgh, heads the company, which was recently organized. H. E. McConnell will be managing director.

PHILADELPHIA—The Henry Bower Chemical Mfg. Co., 29th St. and Grays Ferry Road, specializing in the production of ammonia and kindred products, has filed plans for the construction of an addition to its plant to cost about $25,000. Alterations will be made, also, in one of the existing buildings at the works.

NEW CUMBERLAND—Albert Hanker, operating a local box-manufacturing plant, is perfecting plans for the construction of a new plant in the vicinity of Second and Reno Sts., to be equipped for the manufacture of glazed paper products.

TEMPLE—The Stalium Metals Co., recently organized to manufacture special metals, will commence construction at once of a new local plant to comprise a number of buildings, estimated to cost about $200,000 S. S. Staley heads the company.

Texas

YOAKUM—The Texas Hide & Leather Co. has plans under way for the construction of an addition to its plant to cost about $17,000. Improvements will be made also in the existing works.

RANGER—The Texas-Pacific Coal & Oil Co. has acquired property near Caddo, Tex., as a site for a new gasoline absorption plant, estimated to cost about $100,000, including equipment. Work will be commenced at an early date.

DALLAS—The Allied Chemical Co. is completing plans and will soon break ground for the construction of a 2-story plant at Alma St. and Santa Fe Ave., 40x125 ft., to include a power plant, office and other miscellaneous structures. Initial production will be devoted to boiler compounds and other chemical products. The new plant will cost close to $50,000. W. R. Sparkman is president; and H. H. Howard, vice-president and general manager.

Virginia

HOPEWELL — The Hummel-Ross Fibre Corp. has preliminary plans under consideration for the construction of a number of new plant buildings at its local mill, to be equipped for general production and finishing operations. It is said that the plant will cost in excess of $175,000, including equipment.

Washington

SEATTLE—The J. W. Fales Paper Co. has plans under way for the construction of a new 3-story building at its plant, to cost about $35,000.

West Virginia

HUNTINGTON—The Superior Glass Products Co., Adams Ave. and 19th St., has tentative plans under consideration for the rebuilding of the portion of its plant destroyed by fire, Aug. 2, with loss approximating $150,000, including equipment.

HUNTINGTON—The Eureka Rubber Preserving Co., recently organized with a capital of $400,000, has plans in progress for the construction of a new plant on local site for the manufacture of rubber preservatives, primarily for automobile tire service. The works will include a large experimental laboratory. L. C. Basham is general manager.

New Companies

THE ARTHUR A. LEHMAN CO., New York, N. Y., care of J. Q. Perry, 84 William St., representative, has been incorporated with a capital of $12,000, to manufacture chemicals and chemical byproducts. The incorporators are J. C. Treadwell, A. A. Lehman, and W. T. Easley.

THE SYNTHETIC LEATHER CORP. OF AMERICA, Scotch Plains, N. J., has been incorporated with a capital of $1,000,000 to manufacture paints and affiliated products. The incorporators are R. O. Lipton, Rufus Delafield, and Frederick J. Balmer, Scotch Plains.

THE BALTIMORE WATER PAINT CO., 942 Madison Ave., Baltimore, Md., has been incorporated with a capital of $100,000, to manufacture paints and affiliated products. The incorporators are Herbert C. Metcalfe, I. Brenner, and Albert H. Samuel.

THE FELSTONE CO., Asheville, N. C., has been incorporated with a capital of $100,000, to manufacture pottery and other burned clay products. The incorporators are G. C. Reiniger, C. Marshall Gravatt, and Blair Taylor, all of Asheville.

THE CLAIR CHEMICAL CORP., New York, N. Y., care of J. I. Wiener, 1482 Broadway, New York, representative, has been incorporated with a capital of $10,000, to manufacture chemicals and chemical byproducts. The incorporators are W. A. Miller, R. L. Noah, and L. Rothschild.

THE STATE REFINING CO. INC., Dallas, Tex., has been incorporated with a capital of $400,000, to manufacture refined petroleum products. The incorporators are Shearon Bonner, S. F. Semo, and F. B. Horton, all of Dallas.

THE ROY RUBBER CO., 221 East Hanover St., Trenton, N. J., has been incorporated with a capital of $100,000, to manufacture rubber products. Edward L. Royal, address noted, is the principal incorporator, and represents the company.

THE EBERLING BRICK & TILE CO., Detroit, Mich., has been chartered under state laws, to manufacture brick, tile and other burned clay products. The incorporators are William Lucking, James W. Thomas and Howell Van Auken, 1502 Ford Bldg., Detroit.

THE DE COTTIS CHEMICAL & COLOR CO., Pittsburgh, Pa., has been incorporated with a capital of $10,000, to manufacture chemicals and chemical byproducts, colors, etc. C. Schoemer, 408 Union Arcade, Pittsburgh, is treasurer.

THE LUSTERINE POLISH CO., 2212 West Harrison St., Chicago, Ill., has been chartered under state laws, to manufacture polishes, cleaners, etc. The incorporators are William D. Sheppard and John Schouten.

THE WATSON CHEMICAL CO., Lebanon, Mo., has been incorporated with a capital of $50,000, to manufacture chemicals and chemical byproducts. The incorporators are C. O. McCain, C. G. and E. I. Watson, all of Lebanon.

THE BOONTON MOULDING CO., Boonton, N. J., has been incorporated with a capital of $50,000, to manufacture composition products, moulded materials, etc. The in-

corporators are Frank H. Pierce and George Scribner, Myrtle Ave., Boonton.

THE WYOMING & MONTANA OIL CO., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated under state laws with a capital of $1,000,000, to manufacture petroleum products.

THE RED DIAMOND CHEMICAL CO., Philadelphia, Pa., care of Biddle, Paul, Dawson & Yocum, 505 Chestnut St., Philadelphia, representatives, is being organized by Calvin M. Smyth and Woodward K. Greene, to manufacture chemicals, chemical compounds, oils, etc. Application for a state charter will be made on Sept. 5.

THE MARSHALL METAL CORP., 2608 South Wells St., Chicago, Ill., has been incorporated with a capital of $100,000, to operate a metal fabricating works for the production of aluminum, steel, brass and other metal products. The incorporators are Frank E. Chamberlain, John J. Stream, and John R. Marshall.

THE HAMILTON LEATHER PRODUCTS CORP., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under state laws with a capital of $250,000, to manufacture leather products.

THE PEERLESS LIQUID CEMENT CO., New York, N. Y., care of Stern & Stern, 49 Chambers St., representative, has been incorporated with a capital of $5,000, to manufacture liquid cements and affiliated products. The incorporators are J. Keeler, and S. Lange.

THE TOLEDO ALUMINUM & BRONZE CASTINGS CO., Toledo, O., has been incorporated with a capital of $10,000, to manufacture aluminum, bronze, brass and other metal castings. The incorporators are Otto K. Rudon and Charles M. Kistner, both of Toledo.

THE WHARTON COUNTY OIL MILLS, INC., El Campo, Tex., has been chartered under state laws to operate a local mill for the manufacture of cottonseed oil products. The incorporators are H. E. Wilson, A. L. Lawson, and Hans Goldmann, all of El Campo.

THE BURWALL CHEMICAL CORP., New York, N. Y., care of Tison & Melick, 15 William St., representatives, has been incorporated with a capital of $500,000, to manufacture chemicals and chemical by-products. The incorporators are M. Wittlan, E. J. Russo, and E. C. Beekmann.

HERRMANN, MORRIS & CO., 878 Mt. Prospect Ave., Newark, N. J., has filed notice of organization to manufacture dry colors, chemical specialties, etc. Edwin Blum, 44 West 70th St., New York, N. Y., heads the company.

THE INLAND GLASS CO., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under state laws, with a capital of $1,500,000, to manufacture glass products.

THE FALOR RUBBER CO., 910 South Michigan Ave., Chicago, Ill., has been incorporated with a capital of $50,000, to manufacture rubber products. Shelby A. Falor is president; and C. F. Schnee, secretary.

THE CARNAHAN PRODUCING & REFINING CO., San Antonio, Tex., has been incorporated with a capital of $25,000, to manufacture petroleum products. The incorporators are Henry C. King, Jr., Clinton Chenault, and J. E. Carnaham, all of San Antonio.

THE RELIABLE GAS & OILS, INC., Newark, N. J., has been incorporated with a capital of $50,000, to manufacture and deal in lubricating oils, etc. The incorporators are Hugh F. Gilligan, Harry B. O'Connell, and William F. Haas, 1212 Broad St., Newark.

THE ATLANTA GLASS MFG. CO., Atlanta, Ga., has been incorporated with a capital of $500,000, to manufacture glass products. The company has plans under way for the erection of a local plant. F. J. Cooledge, Jr., Atlanta, is president.

THE AMERICAN OPALOGRAPH CORP., Long Island City, N. Y., care of Weller & Rogers, Jamaica, L. I., representatives, has been incorporated with a capital of $100,000, to manufacture chemicals and chemical by-products. The incorporators are F. J. Klein, C. H. Senior and H. D. Snyder.

THE GRADY BRASS CO., Wilmington, Del., care of the Corporation Service Co., Equitable Bldg., representative, has been incorporated with a capital of $10,000, to manufacture brass and bronze products.

THE UNITED HIDE CO. OF NEW JERSEY, Newark, N. J., care of Harold Simandl, 418 Kinney Bldg., representative, has been incorporated with a capital of $100,000, to operate a local tannery. The incorporators are M. R. Gibney, Leo D. Schwartz and Mark Herbst.

THE RADIO-TONE CHEMICAL CO., New York, N. Y., care of Leon Bleecker, 249 West 34th St., representative, has been incorporated with a capital of $10,000, to manufacture chemicals and chemical by-products. The incorporators are E. G. Coundjeris and E. G. Manias.

THE ALLYNDALE LIME CO., Southington, Conn., has filed notice of change of name to the CAINE LIME CO.

Manufacturers' Catalogs

BAKER & CO., INC., Newark, N. J., has issued its fourteenth edition of "Data Concerning Platinum," which contains new tables, illustrations and matter descriptive of various appliances made of platinum.

THE EAST JERSEY PIPE CO., Paterson, N. J., in a new pamphlet, Bull. X203, illustrates and describes Type B Hercules electric hydro-extractors.

THE BARRETT CO., New York, has issued a booklet on Barrett Flotation Oils and Reagents.

THE LINK-BELT CO., Chicago, is issuing literature on the Link-Belt crawler crane, which is the newest machine from this company's Chicago shops.

THE CONNERSVILLE BLOWER CO., Connersville, Ind., in order to more completely describe its line of small blowers, has just issued Bulletin 21, on Victor Positive Pressure Blowers.

THE SCHUTTE & KOERTING CO., Philadelphia, Pa., has issued a very attractive catalog entitled "Koerting Fuel Oil Burning Systems." It consists of three bulletins which describe mechanical fuel oil-burning systems and fuel oil burners in which the oil is atomized by low- or high-pressure air and steam. It discusses thoroughly the installation, operation and maintenance of oil-burning equipment, its characteristics, requirements and functions, the relative merits of mechanical and spray oil burners, the design, purpose and operation of air control registers, oil-pumping outfits, duplex oil strainers and fuel oil heaters, the general requirements of steam boiler furnaces for burning oil, operation, inspection of the system, lighting the fires, air for combustion, indication of satisfactory operation, number and arrangement of burners, effects of carbon deposits and soot, etc. The catalog is profusely illustrated in color.

THE ELECTRIC FURNACE CONSTRUCTION CO., Philadelphia, Pa., has published two new catalogs. "Electric Furnaces for Melting, Refining and Superheating of Iron and Steel" describes various types of electric furnaces and particularly a new feature of the "Greaves-Etchells" steel melting furnace applied to four or more electrode furnaces. This system permits of all the electrical power being put either entirely through top electrodes or, by change of position of the switch, through top electrodes and through the whole of the furnace hearth, each connection being so arranged as to give a balanced load and a high power factor. This gives a very flexible electric melting unit, having all the advantages of top electrode furnace for melting down, and top and bottom heat for the refining and addition of alloys and finishing off. This bottom heat has been found extremely beneficial during these latter operations, giving as it does slow circulation of the molten bath from the bottom, uniform temperature throughout, and a homogeneous finished product. The other catalog describes the "Electro" steam boiler, developed by F. T. Kaelin, chief engineer of the Shawinigan Water & Power Co. These electric steam boilers take high tension current direct and use the water itself as a resistance. These boilers have a thermal efficiency of over 98 per cent and a unity power factor, and should be of interest to all hydro-power companies or consumers of power who pay on peak or connected load basis.

THE BROWN INSTRUMENT CO., Philadelphia, Pa., announces the publication of a new resistance thermometer catalog which explains the theory of resistance thermometry, the various type of instruments which are made and the merits of each type. Copies will be send to any executive on request.

THE CORNING GLASS WORKS, Corning, N. Y., has issued a pamphlet on Pyrex Industrial Glassware, which is a preliminary announcement of a new stage in the evolution of Pyrex glass, in the application of Pyrex to chemical plant uses. In the pamphlet is a brief description of three typical shapes, with dimensions, prices, etc., and the following are articles either in production or in the final experimentage stage: Socket pipes and bends, "S" bends for cooling and condensation work, pipe lines made of large bore tubes, tubes for catalytic reactions, retorts for distillations, etc., evaporating dishes, flat pans for driers, etc., receivers for hot liquids, flat sheet glass and sight glasses and sight pipe sections. Some of the outstanding features of this glassware are also given.

THE OLIVER-SHERWOOD CO., San Francisco, Calif., announces a new bulletin on "Olivite" centrifugal pumps, which are especially designed for rigorous service in chemical industries. The pump is not a hard rubber pump, but it is of acid-proof character due to a new composition which has a rubber basis, and is adapted to handling and pumping of dilute solutions of hydrochloric, nitric, sulphuric and phosphoric acids.

THE DELAVAL STEAM TURBINE CO., Trenton, N. J., in a 28-page catalog illustrates and describes a line of velocity stage turbine especially designed for high-pressure and high-temperature steam. The cast steel steam chest is located in the casing cover in order to avoid the conduction of heat to the bearings. In addition to the speed governor and governor valve, there is an independent valve controlled by an automatic over-speed trip. The turbines are built in sizes up to 1,200 hp., and are designed to be directly coupled to high-speed centrifugal pumps and blowers, small a.c. and d.c. generators, and by means of double helical speed reducing gears, to large pumps and blowers, medium size generators, belt pulleys, rope sheaves and slow and moderate speed machinery.

THE WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., in Circular 1579-B, on "Micarta Gears and Pinions," describes the development of this material, which is non-metallic, for gear and pinion application that can be advantageously substituted for untreated steel, cast iron, bronze and all other materials used for gearing. It is a laminated product of specially treated woven fabric and can be machined in the ordinary manner. This material was developed to meet the demand for silent gear drives. The company also states that it is not attacked by rodents and vermin; is not affected by water or oil, or by most acid and alkali solutions; can be kept in storage indefinitely without deterioration and is applicable to a great many special constructions. The catalog contains general information and technical data for cutting micarta gears and pinions.

Coming Meetings and Events

ALPHA CHI SIGMA dinner, during the Chemical Exposition, will be held Thursday, Sept. 14, at 6:30 p.m. at Keen's Chop House, 107 West 44th St., New York City. Members are requested to register at *Chem. & Met.'s* booth at the Exposition.

AMERICAN CHEMICAL SOCIETY will hold its fall meeting in Pittsburgh, Pa., Sept. 5 to 9.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its fall meeting in Montreal, Sept. 21, 22 and 23. Headquarters will be at the Windsor Hotel.

AMERICAN GAS ASSOCIATION will hold its annual convention and exhibition at Atlantic City, Oct. 23 to 28.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS will hold its 126th meeting at San Francisco, Calif., Sept. 25-29, 1922.

AMERICAN SOCIETY FOR STEEL TREATING will hold its International Steel Exposition and Convention in the General Motors Bldg., Detroit, Mich., Oct. 2 to 7.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS will hold its sixteenth annual convention Sept. 11 to 15 at Cleveland Public Hall, Cleveland, Ohio.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (EIGHTH) will be held in New York Sept. 11-16.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NATIONAL SAFETY COUNCIL will hold its Eleventh Annual Safety Congress in Detroit, Aug. 28 to Sept. 1.

NEW JERSEY CHEMICAL SOCIETY has discontinued meetings for the summer, but will resume them in October.

SOCIETY OF INDUSTRIAL ENGINEERS will hold a 3-day national convention in New York, beginning Oct. 18. The general topic of the convention is "Economics of Industry."